THE AEROPLANE

Incorporating
Aeronautical Engineering
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AERONAUTICAL CO-EXISTENCE

IT is not surprising to learn that many of the guests who accepted the invitation of the Air Council to attend the conference with the code name "Prospect II" were astonished when they read their newspapers the following day. They were quite unprepared to learn that they had assisted at a frontal attack on Government policy by the Royal Air Force. It had never occurred to them that this extremely well planned and persuasive occasion, staged for May 6, could be construed as an attack on the policies of the Minister of Defence. Unless one's whole existence is devoted to the political game it is quite possible not to be aware of the tactical possibilities that an astute politician can make of a suitable set of circumstances. And any hint of a rift between the political heads of departments can be usefully adapted as a stick to be used by the party in opposition with which to beat the party in power.

We do not propose here to explore the political reactions to the conference. We have no doubt that, whatever the political outcome may be, the practical people in the Royal Air Force have now firmly established that the guided weapon (to whatever degree of sophistication it may be developed) will never be adequate for the defence of these islands and Commonwealth without the appropriate complement of manned aircraft. We ourselves never had any doubt that there was a future for the aeroplane, just as we have no doubt that there is a future for the supersonic airliner, but until the completion of "Prospect II" there had been a lot of doubt in people's minds generally about the future of aeroplanes as used by the Royal Air Force.

Of course there are people, and we are sorry to see that a special correspondent writing for *The Economist* has to be numbered among them, who have the idea that those responsible for directing the Royal Air Force have a sentimental regard for the manned aircraft and in particular for the pilot *per se*. This is strange when the same directing body has been criticized, as it was in the debate in the House of Lords, for ruthlessly cutting down the Royal Auxiliary Air Force. Yet these same men, so sentimental about pilots, had had close personal connections with the Auxiliary Squadrons which they ruthlessly abolished in the national interest.

The truth is that guided weapons are such new arrows in the national quiver, and indeed to be precise are so rare and available in such small numbers, that only those who are engaged in planning their development, production and utilization can be expected to know much about them. For everyone else their capabilities are as much a mystery as their limitations. And these latter are considerable. In due course it is certain to be easier to find counter measures to the guided weapon than to manned aircraft. If the guided weapon behaves properly its behaviour is calculable; if its behaviour becomes incalculable then it is misbehaving and in consequence is of no use to those who have launched it.

It was, naturally, a most attractive idea to those responsible for political affairs to have become persuaded that the coming of the guided weapon meant the end of the aeroplane. This clearly promised a great saving of money or, in effect, that less of the national income need be spent on armament and so more could be spent on material amenities. What "Prospect II" has made quite clear is that we have got to have guided weapons as well as aeroplanes.

There is no need for us here to go over the requirements of the Royal Air Force. These have been clearly set out in a paper by Air Marshal Kyle, the Assistant Chief of the Air Staff responsible for operational requirements. His remarks are reported *in extenso* later on in this issue. We admit, however, to some concern about the assumption pretty general throughout the whole of "Prospect II" that Transport Command is all right. We definitely agree that Transport Command has always done a wonderful job with such equipment as it has got. Nevertheless it is woefully short of equipment at the present time, and even when it has got its 20 Britannias it will still be unable to move enough troops quickly enough nor will even then have the means of moving heavy equipment over long stages.

There has been much talk of stockpiling. This means secure bases and secure tenure. If there is one thing that this country should have learnt to its cost in the past 15 years it is surely the extreme uncertainty of bases. How long shall we have Cyprus?

Looking back to the early thirties, there is a lesson to be learnt from the fact that complete gold mining dredging equipment was flown into the hinterland of New Guinea in Junkers Ju 52 monoplanes. Today it should not be difficult for the Army to call in a few mining engineers and learn from them something about ways and means of sectionalizing equipment for transport by air.

In addition there is a strong school of thought which believes that the very large tank is outmoded. When one considers how small a tank can pack a nuclear punch these days, it ought to be easy to design modern equipment for the Army that the R.A.F. could fly anywhere. It is just such close working together that the Ministry of Defence might be expected to encourage.

MATTERS OF MOMENT

New R.Ae.S. President

ON May 8, Sir Arnold Hall, F.R.S., M.A., Hon.A.C.G.I., F.R.Ae.S., took office as president of the Royal Aeronautical Society for the year 1958-59. He succeeds Sir George Edwards, C.B.E., B.Sc.(Eng.), F.R.Ae.S. Sir Arnold is technical director of the Hawker Siddeley Group and managing director of the recently formed company, Bristol-Siddeley Engines, Ltd.

Educated at Clare College, Cambridge, Sir Arnold was with the Royal Aircraft Establishment at Farnborough between 1937 and 1945, when he became Zaharoff Professor of Aviation in the University of London and Head of the Department of Aeronautics at the Imperial College of Science and Technology. He returned to the R.A.E. as its Director in 1951 and was there until 1955, when he joined the Hawker Siddeley Group. When at Farnborough he was responsible for the Comet accident investigation.

Conferring in Spain

AN international aeronautical conference will be held in Madrid from September 8 to 13. Known as the First International Conference of the Aeronautical Sciences, it has been jointly organized by the Institute of the Aeronautical Sciences, the Royal Aeronautical Society, and other scientific bodies. Eighteen countries with organized technical societies are expected to take part and some 40 papers covering virtually all aspects of aeronautics will be read.

Information about the conference can be obtained from the secretary of the R.Ae.S., Dr. A. M. Ballantyne, at 4 Hamilton Place, London, W.1.

Helicopter Icing Studies

"CANADIAN Research in the Field of Helicopter Icing" was the title of a lecture read before the Helicopter Association of Great Britain on May 9 by Mr. J. R. Stallabrass, of the Canadian National Research Council's low-temperature laboratory. In his comprehensive paper Mr. Stallabrass surveys in detail the work that has been done on helicopter icing, the effects of icing on helicopter operation and the ice-protection systems under development. Problems of helicopter icing have been under study in Canada for five years.

Icing is caused by supercooled cloud droplets which impinge on forward-facing surfaces and form a mixture of ice and water at 0° C.; the proportions of this mixture depend on the degree of supercooling.

Build-up of the ice so formed on a helicopter rotor blade reduces efficiency more than it does on the wing of an aircraft. Rotor-blade profile drag is greatly increased; to maintain rotor r.p.m. the engine power must be increased. Even under moderate icing a manifold-pressure increase of 2 in./min. is by no means abnormal. In these conditions a helicopter is soon forced to land.

Ice accretion has little effect on the lift coefficient at normal angles of incidence or on control forces. Maximum lift coefficient is reduced, however, and the possibility of blade stall increased. Difficulties are also caused by the rotor unbalance which follows uneven shedding of ice.

PRESENTATION PARTY.—Mr. John Lankester Parker whose aviation certificate is No. 813 (1914) retired recently from the board of Short Bros. for which concern he started test flying in 1916. Watched by Rear Admiral Sir Matthew Slattery, he is presented by Mr. L. Stedman, Short's Assistant Technical Manager (GW), with a wristlet watch.

The tail rotor collects more ice than the main rotor and has a greater tendency to self-shedding because of its higher centrifugal forces, resulting in serious vibration.

Icing tests were made at Edmonton with a rig which produced a freezing spray from 151 nozzles. The helicopter under test was hovered downwind of the rig in the icing cloud of particles produced by the spray nozzles. Suitable low temperatures and local wind conditions were needed during the tests, which have been made with a Bell HTL-4, a Sikorsky S-55, a Bell H-13-H and a Bell 47G-2.

Mr. Stallabrass discussed the relative advantages of cyclic rotor-blade de-icing on either spanwise or chordwise strips. The spanwise technique is favoured in America, but Canadians prefer the chordwise method. With the American system the leading-edge strip is energized first to remove most of the built-up ice and thereafter spanwise strips aft of the leading edge are heated.

In the Canadian system chordwise strips are heated in turn, working from the rotor tips inwards, so that sections of ice are shed from each strip in turn. This technique is claimed to give better ice shedding and less chance of rotor unbalance.

Tests have shown that specific heating powers greater than 25 W./sq. in., applied for short periods, give fast clean ice shedding. Increasing the specific power from 15 to 40 W./sq. in. gives a saving in shedding power of about 30%.

The shedding cycle begins when ice is ¼-in. thick on the

PRIZE-WINNERS.—This photograph taken at the A.G.M. of the Royal Aeronautical Society shows (L. to R.) Mr. W. Makinson (Navigation Prize); Messrs Robert Lickley and Peter Twiss (George Taylor (of Australia) Gold Medal); Dr. D. Kuchemann (Edward Burk Memorial Prize); Mr. G. M. Hellings (Navigation Prize); Mr. M. B. Morgan (Branch Prize); Mr. L. F. Nicholson (Simms Gold Medal); Dr. R. R. Jamison (Herbert Ackroyd Stuart Memorial Prize) and Prof. A. R. Collar (Orville Wright Prize).

Photograph copyright "The Aeroplane"

blades. Heat is applied in sequence to the shedding zones, but the heating time is varied to suit icing conditions. A temperature-controlled timer is necessary for this. The use of fixed time cycles is quite unrealistic and might detract from shedding performance or encourage runback of melted ice.

Mr. Stallabrass concludes by saying that he expects helicopters fully protected from icing effects to enter service by the end of 1960.

Canada's Turboprop Transport

MORE NEWS comes from Canada about the new version of the Canadair CL-44 long-range turboprop transport for the R.C.A.F. which is now to have Rolls-Royce Tynes in place of the originally planned Bristol Orions. Now known as the CL-44D, the prototype is still expected off the line late next year. There has had to be some revision of the Canadair/Bristol agreement, and this now permits Canadair to build the aircraft in Canada and sell it with any powerplant "and for any purpose" anywhere in the World except the U.K. where Canadair will be entitled to sell it for maritime reconnaissance purposes.

For the new version with Tyne turboprops the all-up weight is 205,000 lb. and the cruising speed is quoted as 375 m.p.h. For the civil all-cargo version, the payload capacity is given as 66,500 lb. for an operating cost of 5.2 cents per ton-mile. Accommodation in the all-passenger version will be for 150 "economy-class" passengers and in this case the operating cost is quoted as 1.1 cents per seat-mile.

With typical fuel reserves, the company says, the Tyne-engined CL-44D will have a maximum range with "substantial" payload of 5,100 st. miles. With a full passenger load, or 25 tons of cargo, the range will be 4,200 miles and with maximum cargo load it will be just under 3,000 miles.

Span of the CL-44D—the airframe of which is based on that of the Britannia—is 142 ft. 3 in. Its length overall is 136 ft. 9 in.

Another Britannia-based Canadair aeroplane, the CL-28 Argus maritime reconnaissance anti-submarine aircraft for the R.C.A.F., is to go into squadron service this week-end, with No. 405 Squadron of the Maritime Air Command. Details of the Argus and its background together with photographs are on pages 681 to 683 of this issue.

D.S.I.R. Annual Report

THE annual report of the research council of the Department of Scientific and Industrial Research draws attention to the success of the Jodrell Bank radio telescope in locating the Russian satellites by radar. It was apparently the most successful instrument in the World for this purpose.

The report also describes the current aerodynamic work of the National Physical Laboratory. Fundamental studies are being made of steady and unsteady flow over aerofoils at all speeds, including the hypersonic range. Special attention is being paid to transonic problems and to techniques which will enable aircraft to take off and land from short runways.

Other work of aeronautical interest has been concerned with checking the accuracy of fine-pitch gears for radar and fire-control equipment, with improving the effectiveness of air-to-ground and airport-to-airport radio communication over long distances, and with checking the pitch error of serrations in the "fir tree" roots of gas-turbine discs.

Rotorcycle Demonstrated at Elstree

HILLER'S prototype XROE-1 one-man helicopter, the Rotorcycle, is at present on a sales tour of Britain and Europe. At Elstree where it arrived in a motorvan for a demonstration, we watched two men assemble it in three minutes. The record is 1 min. 50 sec. Its capabilities for military and civil use are being demonstrated; Rotorcycles have already been ordered for military evaluation by Germany and Switzerland.

Designed to meet a U.S. Marine Corps requirement for a foldable one-man helicopter, the Rotorcycle can be used for reconnaissance, courier work, wire-laying and as an airborne communications station. Rotorcycles can also transport small but urgently needed equipment; they can be air-dropped from light aircraft for use as rescue vehicles. They could also be used in force to carry assault troops.

A conventional helicopter in miniature, the Rotorcycle has two-bladed main and tail rotors and a 45-h.p. Nelson two-stroke piston engine. This four-cylinder horizontally-opposed air-cooled engine weighs only 73 lb. when complete with its exhaust system, cooling fan, clutch and cowling.

The Rotorcycle weighs 300 lb. unladen and has a maximum all-up weight of 556 lb. It cruises at 55 m.p.h. and its top speed is 70 m.p.h. Its range with a 170-lb. pilot and no payload is 166 miles. A more realistic operation, however, would be with a 180-lb. pilot and a pack weighing 60 lb.; range in this case is 34 miles. Maximum rate of climb is 1,160 ft. per min. Fuel consumption at cruise power is 11 miles per U.S. gallon.

After being hand started—production aircraft will have an electric starter—the prototype Rotorcycle took off and was effectively demonstrated despite a wind gusting up to at least 25 m.p.h. Manœuvrability appeared excellent and the helicopter was hovered at low level despite the gusty wind.

The cost of production aircraft will be $10,000. It is intended that the Rotorcycle should be produced in Europe to avoid exchange difficulties; the licensee is Helicop-Air of Paris. Pictures on page 672.

TACTICAL FIGHTER? — It was stated in the House last week that the Folland Gnat (Bristol Orpheus turbojet) is being seriously considered as a successor to the D.H. Venom. Operational trials for possible Venom replacements are to be held in Aden this summer. On the right is a Folland-built Gnat for the Indian Air Force.

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The Wallis Swallow

SPECULATION about one of the most stimulating aeronautical projects of recent years has been rife during the past week. This is a proposal—by Dr. Barnes Wallis, C.B.E., D.Sc.(Eng.), F.R.S., R.D.I., M.Inst.C.E., F.R.Ae.S., chief of aeronautical research and development at Vickers-Armstrongs—for a supersonic aircraft embodying a variable-geometry wing. In this, the outer portions can be swept forward at low speeds, to a position approximately at right-angles to the line of flight, to give the best possible take-off and landing characteristics. To this end, the basic shape is said to be a narrow delta. The outer wings in the supersonic configuration continue the sweep of the basic shape but owing to the narrow chord form an overall Vee, hence the name "Swallow."

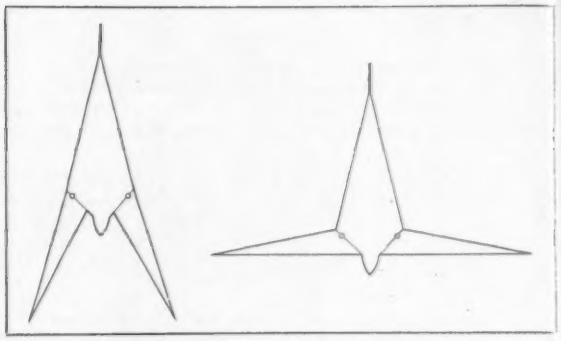
No official details of the project have been forthcoming and Vickers have no comments to make. But however accurate, or otherwise, the recent speculations concerning it have been, one thing is quite certain—as it comes from the board of such an eminent aeronautical engineer as Dr. Wallis, the many problems involved in such a radical layout are bound to have been tackled with ingenuity.

The project would seem to be aimed at getting the best of both aerodynamic worlds coupling all the supersonic advantages of a very highly swept wing with the low-speed performance of a more orthodox layout. Two of the major drawbacks of a delta or near-delta wing chosen for speeds of the order of M=2.5-3.0 is the extremely nose-high attitude that it adopts at low speeds coupled with very high induced drag in low-speed flight. The attitude problem brings in its train considerable difficulties in providing a suitable undercarriage and—more important—in providing a good view for the pilot for take-off and landing. One solution to this sort of problem can be seen in the Fairey Delta's "droop snoot" cockpit which keeps the pilot in a more orthodox attitude while the rest of the aeroplane takes up its characteristic low-speed high angle of attack.

In his approach to these problems Dr. Barnes Wallis has endeavoured to devise a wing form that can be changed from the optimum low-aspect-ratio high-speed layout to the best compromise shape with a higher aspect ratio that would be suitable for low speeds. Clearly this change of geometry brings with it a corresponding change in the position of the centre of gravity which must move forward in the second (low-speed layout) of these two configurations.

Unofficial drawings that have appeared in the Press have shown powerplants mounted on the moving portion of the wing—which at first sight, on the score of C.G. shift, seems difficult to accept. It is possible, however, that matters have so been arranged that the centre of gravity will still be in the correct position relative to the centre of pressure, which in the low-speed layout and condition will be much farther forward than in the high-speed condition.

This neat solution to the longitudinal stability problem cannot, of course, be had for nothing and with the powerplants mounted on the pivoted portion of the wing it is necessary for them, too, to be pivoted so that they can remain in the line of flight. Although this would seem to be an added complication it is, however, an arrangement that provides a means of overall control by jet reaction. Indeed, it has been suggested that the powerplants can be made to swivel in the fore and aft plane as well as in azimuth, in order to give longitudinal as well as directional control.



Such a reaction-control system on its own, though, would pre-suppose "power on" during the last stages of the landing approach and, therefore, enough thrust to make for high landing speeds. It may well be that some more orthodox controls figure in the low-speed configuration.

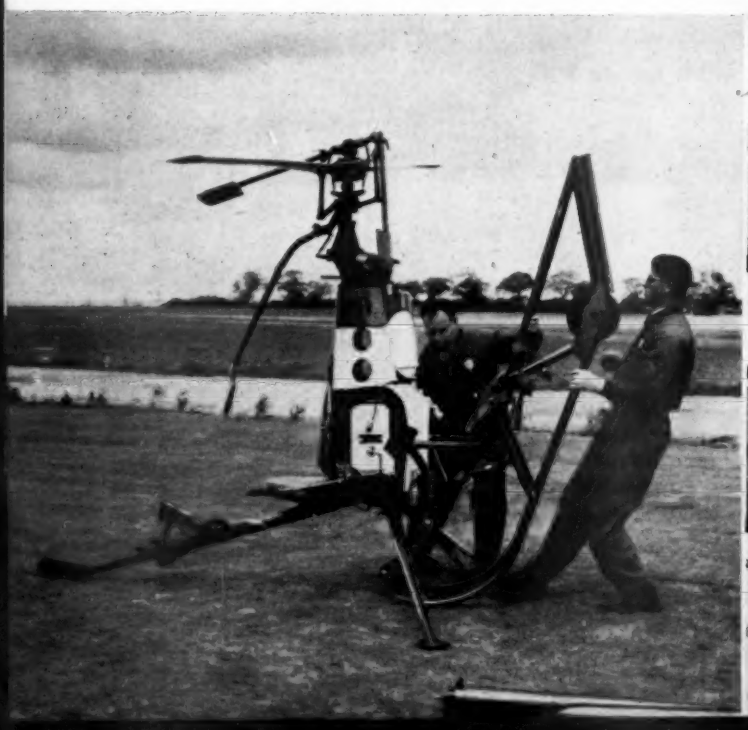
According to reports, Dr. Barnes Wallis has neatly solved the kinetic heating problem by a vacuum system. In this, presumably, the outer skin at the leading-edge will be of a material capable of withstanding the high temperature but would be separated from an inner skin and the structure by an evacuated space through which the heat could not be transmitted.

As we have said, no information is available on this remarkable project—work on which has been going on for some years. Exactly how far this work has progressed cannot be ascertained but it is known that it started as a long-term aerodynamic study sponsored jointly by Vickers and the M.o.S. Ministry support for it was withdrawn during the economy cuts a year ago.

Recently a senior party of U.S. Service and Government scientists and engineers were shown the drawings and models that have been made and tested. Despite the lack of British official support for this far-sighted project, there are many who believe that it should be taken a step farther and out of the model stage.

ROTORCYCLE UNFOLDED.—After its packaged arrival (bottom centre), the Hiller Rotorcycle is unloaded on its carrier frame (middle centre), rapidly unfolded and rigged for flight (left), and fuelled (upper centre); during a demonstration flight it hovers in a gusty wind (right).

Photographs copyright "The Aeroplane"



PRODUCTION AT CHESTER.—Comet 4s in production at The de Havilland Aircraft Company's Chester factory.

News of Aircraft, Engines and Missiles

AIRCO ARRANGEMENT. — The Aircraft Manufacturing Co., Ltd., formed recently by de Havilland, Hunting and Fairey, has arranged with Wg. Cdr. R. H. Stocken, managing director of Airco, Ltd., to take over the name "Airco" as it was the original trade name of the old A.M.C. before and during the First World War. The name of Airco, Ltd., has accordingly been changed to R. H. Stocken and Co., Ltd.

DART HERALD NEWS.—Since its first flight on March 11 the Handley Page Dart Herald has spent 70 hr. in the air. It has received a provisional C. of A. and the company states that "difficulties encountered have been few and of a very minor nature." The full C. of A. is expected by the end of the year. A second prototype is to fly this summer and a furnished aircraft is to be demonstrated at the S.B.A.C. show.

WORLD'S HEIGHT RECORD.—The F.A.I. has now confirmed the absolute height record of 30,942 m. (101,516 ft.) set up by Maj. D. G. Simons, U.S.A.F., on August 19-20, 1957, in a balloon which went up from Crosby, Minnesota. This record replaces that established by Capts. O. A. Anderson and A. W. Stevens as long ago as November 11, 1935, in the balloon "Explorer II."

ANOTHER RECORD?—A Lockheed F-104 is reported to have reached a height of 91,249 ft. at Palmdale, Calif., more than 1,000 ft. higher than that achieved by the Sud-Aviation Trident II on May 3.

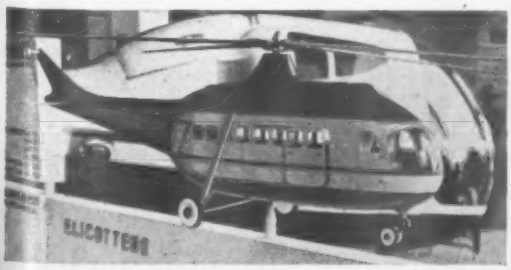
MISSILE EQUIPMENT.—Alternators produced by de Havilland Propellers, Ltd., have been ordered as standard equipment for the Bristol Bloodhound and Armstrong Whitworth Seaslug surface-to-air missiles; they are also used in de Havilland's own air-to-air Firestreak, and are standard too in the P1.B, Javelin and Sea Vixen. Cold-air units manufactured by de Havilland Propellers are used in the Victor, the Scimitar, the P1.B and the Sea Vixen; among civil applications for these units is the Comet 4.

CONWAYS FOR ALITALIA.—According to a correspondent in Italy, Alitalia have now specified Rolls-Royce Conway turbojets for the four Douglas DC-8s which they have on order.

KAMAN COMMERCIAL.—The Kaman K-600 has been developed from the military HOKs, HUKs and H-43As. Two inboard upper and lower fins have been added to the tail for greater stability.

CJ-805 DEVELOPMENT.—General Electric have now begun flight testing the CJ-805 commercial version of their J79 turbojet intended for use in the Convair 880. The first flights are being made in a Douglas XF4D-1 Skyray. Meanwhile, the company is developing variants of the J79 and the CJ-805 which have an additional large-diameter compressor stage, making them virtually by-pass engines with thrust increased by 25% and s.f.c. reduced by 10%. The commercial version is designated CJ-805-21.

B-47 MODIFICATIONS. — The U.S.A.F. is to modify its entire fleet of more than 1,400 Boeing B-47 Stratojets as a result of a series of accidents to the bomber. The modification programme will take several months to complete, but the overall strength of the Strategic Air Command is reported to be unaffected.



ITALIAN PROJECT. — Shown at the recent Milan Fair was a model of the Augusta Z.101D helicopter designed to seat 27 passengers. Powered by three Turboméca Turmo III engines, it is to have a top speed of 150 m.p.h.

R.Ae.S. GARDEN PARTY.—This year's garden party organized by the R.Ae.S. will be held, by kind permission of the Air Ministry and the Fairey Aviation Co., Ltd., at White Waltham aerodrome on Sunday, June 22.

NAVAL ATTACKER.—Due to be shown for the first time soon is the North American A3J twin-jet "attack weapon system" for the U.S. Navy.

ELECTRA ANTI-ICING.—During a programme involving 44 flights and 144 flying hours, the Lockheed Electra has now completed its anti-icing tests. The programme involved flights from Anchorage, Alaska, whence the aircraft returned non-stop to Burbank, California, covering 2,478 miles at a block speed of more than 400 m.p.h.

ANOTHER F-27.—The second Fairchild F-27 has now made its first flight at Hagerstown and the third aircraft, which is due to be delivered next month to the West Coast Airlines, should have flown by the time this issue appears.

RUSSIAN ATOMIC ROCKET?—U.S. sources suggest that a Russian atomic rocket engine was test-fired recently. It is reported that this prototype engine uses a medium-temperature reactor and liquid hydrogen as a working fluid to achieve 22,000-55,000 lb. thrust and a specific impulse of 500-600 sec.

NOTHING NEW.—Work at the Naval research laboratory, Washington, by Dr. Horace Trent suggests that the crack of a stockrider's whip is caused by the fact that the end of the whip moves at supersonic speed. Experiments showed that the speed achieved by this "very simple mechanism" must be nearly 1,000 m.p.h. at the whip's end.

Commercial Aviation Affairs

BRITANNIAS TO SAN FRANCISCO.—On May 6 B.O.A.C. introduced Britannia 312s on the service between London and San Francisco. The Britannia service on this route will be operated twice weekly, with an elapsed time of 22½ hours for the east-west journey.

RECORD FERRY BOOKINGS.—Silver City's vehicle-ferry bookings for 1958 now top the 36,000 mark, compared with about 14,000 cars booked at the same time last year. It is expected that the year's car traffic on the ferries will exceed 50,000.

TU-104 AT STANSTED.—Although not permitted to land at London Airport (because, presumably, of its high noise level), a Tu-104 landed on May 11 at Stansted Airport, Essex. It was bringing the Moscow Arts Theatre company to Britain, where they began a London season this week. The aircraft was about four hours behind schedule because of a weather delay at Copenhagen.

TWIN PIONEER TOURS.—Twin Pioneer G-AOEN, which has been overhauled in Mexico, should now have started on a series of demonstration tours in Central America. Another Twin Pioneer is due to start a tour of the Middle East this month.

B.E.A. AT HANOVER.—During the 10 days of the Hanover Trade Fair (see last week's issue, p. 652), a B.E.A. S-55 helicopter shuttled 1,150 passengers between Langenhagen Airport, Hanover, and a landing site within walking distance of the Fair.

707 NOISE TESTS.—During recent sound-level measurements of the Boeing 707 at Seattle, two members of the staff of M.T.C.A.—Dr. G. E. Bell, who heads the operational research branch, and J. G. Roberts—took part in the work of sound measuring and recording. During the flight phases of the demonstration, the 707 was taken off at a weight of 225,000 lb. using water injection for the JT3C-6 (J57) engines.

AUSTRIAN VIKING.—Eagle Aircraft Services have recently overhauled and converted a Viking (OE-FAE) for Aero-Transport of Vienna. It has had its British C. of A. renewed and has a new centre-section and lower spar-boom. It is fitted with special freight doors and with 36 Payloader seats. This Viking was originally used by B.E.A. as G-AHPF and before being brought back to this country by Eagle had served with Aviation Traders, B.W.I.A. (as VP-TBC) and C.A.A. (as VP-YJB).

DC-8 FOR IBERIA.—According to *Aviation Daily*, Iberia (Spanish Airlines) have ordered two Douglas DC-8s for delivery in 1960, and have an option on a third. This brings the total number of DC-8 orders to 140. Northwest Airlines are expected to place an order shortly for five DC-8s.

MOSCOW-DELHI PROVING. — On May 18 Air India will make a proving flight over their new Delhi-Moscow route using a Super Constellation. At about the same time Aeroflot will fly a Tu-104 to Delhi.

EL AL INCIDENT.—When leaving London Airport for New York early on May 2, an El Al Britannia 313 shed, on take-off, the inner forward wheel of the port bogie undercarriage. The wheel, the loss of which had not been noticed, was fortunately found near the runway at L.A.P. before the aircraft was due to arrive at Idlewild, so the captain could be told of the loss and was able to complete his landing with appropriate care.

B.O.A.C. CARGO.—B.O.A.C.'s cargo department, formerly at Airways Terminal, Buckingham Palace Road, has now moved temporarily to 14 Dilke Street, Chelsea Embankment, London, S.W.3. The move has been made to allow alterations and improvements at Airways Terminal to be completed.

ARCTIC CARAVELLE.—The cold-weather trials of the Sud-Aviation Caravelle were completed earlier this month by S.A.S. During the trials a series of 20 flights, totalling 45 hours, was made from Stockholm and from Lulea near the Arctic Circle. Ground temperatures during the trials ranged from 0° C. to −30° C.

ATLANTIC ANOMALY. — T.W.A. report that during April they carried 67.5% more de luxe and first-class passengers from the U.S. to Europe and the Middle East than in April, 1957.

CLAIM SETTLED. — Vickers-Armstrongs, Ltd., are reported in Rhodesia to have agreed to pay Central African Airways damages of £125,000 for the loss of a Viking which crashed in March, 1953. The settlement follows a Court ruling that C.A.A. were entitled to sue Vickers for damages.

BALPA CANCELLATION.—The 21st Anniversary Ball arranged by the British Air Line Pilots Association for May 16 (see last week's issue, p. 643), has had to be cancelled.

THE HERMES ACCIDENT.—At the inquest last week it was learnt that the accident to the Skyways' Hermes near Stansted on April 1 was caused by the jamming of the elevator control mechanism by a "loose article." Before the impact the captain explained over the radio that his controls were jammed and that they were "going to hit the ground. Going to hit the ground—now."

News About People

FERRANTI APPOINTMENT.—Mr. Sebastian Z. de Ferranti has become the managing director of Ferranti, Ltd. Sir Vincent de Ferranti remains chairman.

JOHNSTON MEMORIAL TROPHY.—The Guild of Air Pilots and Air Navigators has awarded the Johnston Memorial Trophy to Sqn. Ldr. J. H. Lewis, A.F.C., who commanded the R.A.F. detachment with the British Commonwealth Trans-Antarctic Expedition, for air navigation during the unit's flying support of the Expedition and for making the first air crossing of the Antarctic in a single-engined aircraft. The Trophy is awarded for the year's most outstanding feat or performance in aerial navigation.

ANNIVERSARY CO-ORDINATOR.—From Canada comes the news that Wg. Cdr. Harold Pearce, M.B.E., C.D., F.R.P.S., has been appointed national co-ordinator of the National Co-ordinating Council for the Golden Anniversary of Flight in Canada. The Council has members representing the Armed Forces, civil Government departments, the aircraft industry and operators, etc.

THOSE RESPONSIBLE.—This photograph taken after the first flight of the Blackburn N.A.39 at Thurleigh on April 30, includes the chairman of Blackburn and General Aircraft, Mr. Eric Turner; directors Mr. N. E. Rowe, Mr. T. Bancroft, and Capt. E. D. G. Lewin; technical, works and inspection personnel, and representatives of numerous sub-contractors. All four Blackburn test pilots are also in the group.

D.H. EXECUTIVES.—Mr. J. K. Brown (left), formerly public relations manager of the D.H. Engine Co., Ltd., has been appointed Middle East regional manager for the D.H. Group of Companies. He is succeeded by Mr. J. E. Scott, who will be assisted on publicity matters by Mr. K. T. Fulton (right)—formerly of THE AEROPLANE technical staff.

MASTER PILOTS.—The Guild of Air Pilots has awarded the Master Air Pilot Certificate to Capt. C. H. Gray, flight superintendent of Trans-Australia Airlines, and to Mr. B. F. Russell, chief flying instructor at the College of Aeronautics, Cranfield.

P.A.A. CHANGE.—Mr. James O. Leet, Pan American's district traffic and sales manager in London, has been appointed to a similar post in New York. He has been succeeded in London by Mr. William H. Lyons, previously regional director for the Iberian Peninsular and Africa.

CONSULTANT CORRECTION.—We have been informed by Tiltman Langley, Ltd., of Redhill, that the name of Mr. W. E. P. Johnson, A.F.C., C.P.A., A.F.R.Ae.S., was included in the list of their aeronautical consultant team, published last week, in error.

BALPA APPOINTMENT. — Capt. M. W. Broom, of B.E.A., has been elected chairman of the British Air Line Pilots Association's Technical Committee. After service in the R.A.F., Capt. Broom joined B.E.A. in 1946 and has been active in the technical affairs of the association.

SCOTTISH DIRECTOR. — Mr. Bernard Boxall, B.Sc., A.C.G.I., M.I.Mech.E., M.I.Prod.E., has been appointed to the board of Scottish Aviation, Ltd., as deputy chairman. In his work as deputy managing director of Production-Engineering, Ltd., he has been in close contact with the aviation industry for a number of years, both on the manufacturing and operating sides.

PRESTWICK POST.—Mr. Bernard Boxall, who is appointed deputy chairman of Scottish Aviation, Ltd.

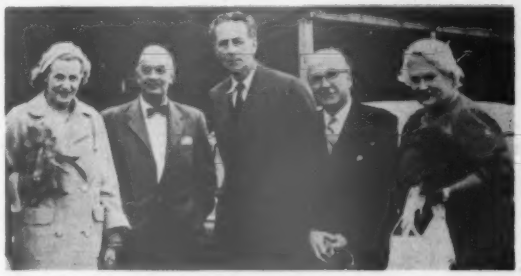
Recognition of Merit

More R.Ae.S. Awards have been announced. They are:—

Sir Richard Southwell (Honorary Fellowship); Mr. W. E. Nixon (Honorary Companionship); Sir Sydney Camm (Gold Medal); Dr. P. B. Walker (Silver Medal); Dr. D. Williams (Bronze Medal); Mr. S. D. Davies (British Gold Medal for Aeronautics); Mr. W. H. Lindsey and Mr. W. F. Saxton (British Silver Medal for Aeronautics); Mr. W. Tye (Wakefield Gold Medal); Mrs. Anne Burns (R.P. Alston Medal); Mr. P. A. Champion (N.E. Rowe Medal).

ORENDA APPOINTMENT. — Mr. Earl Redfern, formerly repair and overhaul superintendent of Orenda Engines, Ltd., has been appointed production manager of the company.

MILES PILOT.—Flt. Lt. Duncan McIntosh, 36, has been appointed chief test pilot of F. G. Miles, Ltd., of Shoreham. He is a former member of No. 603 (City of Edinburgh) Sqn., R.Aux.A.F.



NAVAL INTEREST.—The Earl Selkirk, First Lord of the Admiralty (centre), recently visited Flight Refuelling, Ltd., and inspected equipment being developed for the Royal Navy. With him are, left to right, Lady Selkirk; Wg. Cdr. H. C. Johnson (Flight Refuelling, Ltd.); Sir Alan Cobham, (managing director) and Lady Cobham.

Military Aviation Affairs

HUNTERS AT HUCKNALL.—The Hunter 6 aerobatic team of No. 111 Sqn. (Sqn. Ldr. R. L. Topp) is to be the highlight of the R.A.F. Association eastern area air display at Hucknall aerodrome, Nottingham, on Whit-Monday, May 26.

R.A.F. TWIN PIONEERS.—The first three Scottish Aviation Twin Pioneers for the R.A.F. have gone to Boscombe Down for evaluation trials and it is expected that the first squadron will be operational by midsummer. Meanwhile, two Twin Pioneers for Borneo Airways arrived in Labuan on April 29, and the first Malayan aircraft (for H.E. the High Commissioner) has gone into service with an R.A.F. crew based in Singapore.

R.C.A.F. HELICOPTER TRAINING.—No. 108 (Helicopter) Communications Flight of the R.C.A.F. is to become a heavy helicopter training unit in June. To be known as No. 5 Operational Training Unit, it will be equipped with two Sikorsky H-34 Choctaws and one Vertol H-21A Shawnee.

A BELGIAN DISPLAY.—The Liège Air Meeting is to be held at Bierset aerodrome from June 27 to 29, and will include many flying events and a static exhibition. The R.A.F. and the U.S.A.F. will take part, so will the air forces of Belgium, Canada, Denmark, France, Greece, W. Germany, Italy, Portugal and Turkey, many of them with aerobatic teams. The Federation of Belgian Aero Clubs will hold a rally. Aircraft types to be shown will include Hunter, Vulcan, B-47, B-66, F-100, F-86F, RF-84F and G, C-130, Super Mystère, Djinn and Alouette helicopters, and—for the first time in Europe—the Lockheed F-104 Starfighter and the McDonnell F-101 Voodoo.

PAKISTAN PREPARATION.—It is reported that four B-47 Stratojets of the U.S.A.F. will go to Pakistan in 1959 for the training of P.A.F. crews in preparation for American bomber deliveries in 1960.

VICTOR SQUADRON.—No. 10 Sqn., the first Handley Page Victor squadron in Bomber Command, received its first aircraft recently. Commanded by Wg. Cdr. C. B. Owen, the Squadron is based at R.A.F. Cottesmore. No. 323 O.C.U. at Gaydon has been operating the Victor for some months training crews for the new squadron.

THOR FOR WOOMERA?—A U.S. report says that the U.S.A.F. may accept an Australian offer of test-range facilities at Woomera for the Thor IRBM.

I.O.W. EXPORT.—The first of 10 Saunders-Roe Skeeter light helicopters (D.H. Gipsy Major 215 engine) for the West German Forces. The type is also in quantity production for the British Army Air Corps.

AIR TRANSPORT

VITAL LINK.—One of the few flying-boat services in the World is that operated by TEAL between Fiji and Tahiti via Western Samoa and the Cook Islands. Flown with Solents, it has provided these points with the only regular air link during eight years. The boats will probably continue to be used for another two years until airstrips are laid down.

Doppler Navigator Demonstration

FOLLOWING a Continental demonstration tour of their first commercial Doppler navigation system to representatives of European governments, airlines and aircraft manufacturers, Marconi's Wireless Telegraph Co., Ltd., arranged a number of demonstration flights from Blackbushe last week for United Kingdom companies. Known as the AD 2300 series, the equipment is the first of such systems for civil requirements to be demonstrated in flight, and incorporates a number of new features over the company's earlier Doppler navigators for military applications.

The AD 2300 series is available in three versions: a basic Doppler sensor, providing only groundspeed, drift angle and miles flown; the basic sensor plus a computer to give track guidance on a flight plan, and the sensor plus a comprehensive computer for complete navigational information. It uses continuous-wave frequency modulation, as opposed to a pulse system in the company's earlier equipments, electro-mechanical tracking, and automatic signal search, lock-on and memory.

Suitable for operation from 50 to 50,000 ft.; angles of climb or descent up to 10°; angles of bank of 20°; drift angles of 30°, and a groundspeed range from 80 to 900 knots, the equipment has a minimum weight (basic sensor) of under 100 lb. During the demonstrations over the Continent the average error at the end of a triangular course was approximately 0.5% of the distance flown.

A full description of the navigator, with an account of a flight demonstration, will appear in next week's issue of THE AEROPLANE.

The Marconi commercial Doppler navigator demonstration installation in an Airwork Viking. At the top is a flight instrument display, with the Doppler demonstration and monitor units below it.

Heliports on the Thames

A PUBLIC local inquiry by the Minister of Housing and Local Government into a proposal by Rotorports, Ltd., to moor a floating platform off the Albert Embankment, London, S.E.11, began in County Hall, Westminster, on May 8. The company wishes to use the platform as a heliport for Central London. It was stated at the inquiry that London is the only major capital city in Western Europe without this facility.

Objections to the proposal were lodged by London County Council; Westland Aircraft, Ltd., which proposes to build a helicopter station at Battersea; B.S.A. Tools, Ltd.; the Legal and General Assurance Co., Ltd.; Vickers, Ltd.; Westminster Hospital, and various owners and occupiers of nearby sites, including the Duchy of Cornwall.

For Rotorports, Ltd., Mr. Michael Beckman said that at present the application was for acceptance in principle, and at this stage matters of detail were not sought—they would be dealt with after the inquiry by the appropriate authorities.

On May 15, we have been informed, an application by Westland Aircraft, Ltd., was to be heard. Their proposal concerns a landing stage to be built out into the river from the South Bank at a site in Battersea.

On page 698 illustrations of the two proposals will be found. We understand from Rotorports that transport between the landing platform and Albert Embankment will probably be by boat. No doubt one of the matters which will receive much consideration in such proposals is the availability at the site of links with existing means of road and rail transport.

More About the Il-18

IN their efforts to establish an export market for their new generation of civil transport aircraft, the Russians are making available an increasing amount of information on these types. In our issue of April 25, we published some leading particulars on the Ilyushin Il-18 Moscow turboprop transport, which were displayed by the Russians at the Brussels Exhibition, and some additional details of this aircraft have now come to light.

Perhaps the most interesting feature of the latest release is the attention paid, for the first time by the Russians, to the economic aspect of air transport. The Soviet airline Aeroflot has apparently been run, in the past, with brief regard to such bourgeois considerations as making money, or even of covering expenditure—evidenced by the extremely short lives of engines, components and accessories, and low useful load factors.

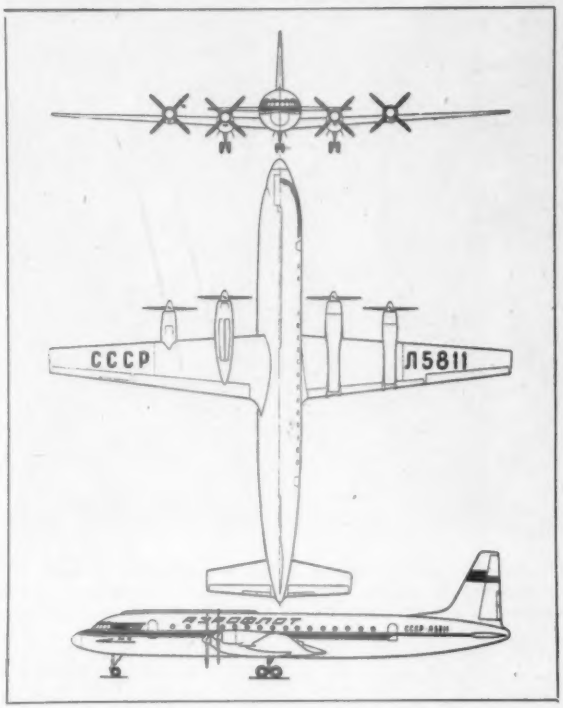
The new transports, however, are designed to compare favourably with Western aircraft in performance, comfort and economy, with the additional appeal of lower first costs, more rapid delivery and, for operators contemplating services into the U.S.S.R., substantial servicing and maintenance advantages. The airframe cost of the Il-18 has been quoted as 6,000,000 roubles (approx. £536,000 at the current exchange rate of 11.2 roubles to the pound), while the price of each 4,000 e.h.p. Kuznetsov NK-4, or Ivchenko AI-20, engine, is 400,000 roubles, or about £35,660, bringing the total aircraft cost to something like £678,640. This is about £25,000 cheaper than the quoted price for the domestic version of the Electra.

Airframe life is calculated at 20,000 hours, with 2,500 hours between major overhauls, while the corresponding engine figures are 1,600 and 400 hours respectively. Interpreted by current Western standards, these figures appear remarkably low, and would make favourable operating economics difficult to achieve, however cheap were spares and replacement components.

The Russians nevertheless maintain that passenger fares in the Il-18 will be the same as for equivalent journeys by rail, because of the low fuel consumption and the payload-weight ratio of 53%. The passenger/kilometre cost will be half that of the aged Il-14—at 0.12 roubles, or 4.14d. per passenger/mile. It would appear that Russian railways are rather expensive.

These operating costs and other data are at present being checked by Aeroflot with two Il-18s on route-proving flights. Over stage lengths of about 1,850 miles the maximum payload is 30,865 lb., when cruising at 350 knots and 26,200 ft. In its tourist layout, the Il-18 carries up to 98 passengers, while the first-class version seats 75. A special executive version is also planned with two beds in the forward cabin and with the rear cabin divided into a lounge, with sofas, tables and armchairs, and a 20-seat rear compartment.

Seat pitch can be quickly varied via the attachment rails in the cabin, which has 6.5 ft. headroom. The centre aisle width is just under 1 ft. 8 in., and the double-surfaced windows are 15.7 in. in diameter. Cabin pressure is maintained to the equivalent of sea level up to 17,000 ft., and then allowed to decrease to an equivalent 5,000 ft. at 26,000 ft., when the differential is 7.1 p.s.i. Cabin air temperature is maintained between 62.6 and 70° F.

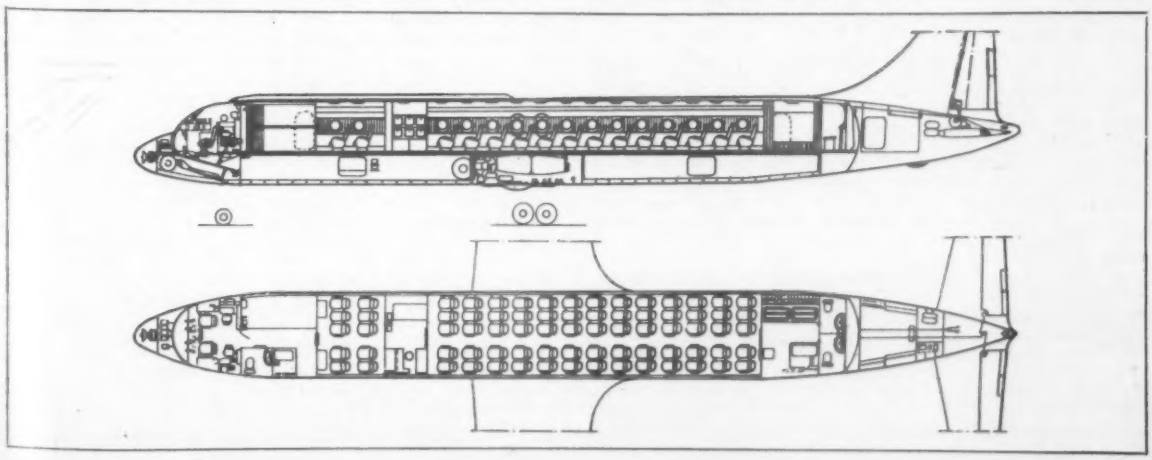


An official Russian drawing of the Il-18.

Layout of the first-class version of the Il-18 is shown in the accompanying drawings. The two pressurized underfloor holds each have a capacity of 14 m.³ (495 cu. ft.), while behind the rear pressure bulkhead is another 600-cu.-ft. compartment for freight or baggage.

Pressure air is bled from the compressors of the turboprop powerplants, which drive 13.7-in. diameter AB-68B airscrews. These have auto-feathering and reverse pitch for braking and, like the leading-edges of the wings, tail surfaces, spinners, engine intakes and windscreen, are de-iced by electro-conductive elements. The Il-18 has eight 12-kVA. variable-frequency alternators, together with 28-V. DC starter/generators providing a total of 130 kilowatts and 24-V. DC stand-by accumulators.

Actuation of the tricycle bogie undercarriage is hydraulic, through a duplicated pump system, at 3,000 p.s.i., which also



MANCHESTER EXTENSION.—This air-to-ground picture shows the extension to the south-west end of Ringway's main runway, which now has a length of 7,000 ft. The extension was recently opened by the Minister of Transport (see THE AEROPLANE, May 2, page 613).

Airviews photograph

supplies the power for the nosewheel steering through 45° each side of centre. There is also an emergency system employing nitrogen compressed to 2,100 p.s.i. in steel accumulators. All three undercarriage legs retract forward so that gravity and slipstream assist their extension. Like all large Russian aircraft except the biggest Tupolev designs (Tu-95 and Tu-114), the Il-18 has an unassisted control system, and its manually operated surfaces are apparently fitted with some form of automatic control lock.

Fuel tanks in the wings have a total capacity of 5,280 Imp. gal., and give a maximum range of 3,100 st. miles with 1½ hours reserve. Landing speed is given as 160 km./hr., or 86 knots, which is remarkably low, but fits in with the Aeroflot requirement for operation from grass airfields of moderate size.

Flight Plan Computing

IN selling the Caravelle, Sud-Aviation have been making much use of an International Business Machines IBM 704 computer installed at the Paris headquarters of Compagnie IBM France.

This computer can produce typical flight plans to meet any set of conditions in about five seconds, compared with the half-day or so required by a manual operator working with the same precision. Although these flight plans have been used primarily to demonstrate the performance of the Caravelle over specific routes, there is no reason why the IBM 704 should not be used in a similar way to provide actual flight plans for operational use, or to build up a comprehensive set of basic references.

The electronic "memory" of the IBM 704 has a capacity of more than 200 million binary digits. This memory has to store three kinds of information: first, the set of mathematical instructions needed to resolve the problem; secondly, basic aircraft data, such as empty equipped weight, take-off weight for a given airfield length, temperature and altitude, and fuel consumption under various flight conditions; thirdly, data applicable to the particular flight to be made, such as average temperature, wind strength, airfield altitude, length of journey and particulars of runways.

The machine works on what is essentially a "trial and error" basis, at a speed of about 42,000 arithmetic steps a second. As soon as an answer conflicts with the specified conditions, the working hypothesis is modified, and this process continues until all the conditions are satisfied. The answers are printed on paper and recorded on magnetic tape. The illustration shows part of a set of Caravelle flight plans produced by the IBM 704. In each case, two answers had been worked out, one assuming zero wind, and the other a typical headwind for the sector in question.

In this example, the machine has been told the stage distance, runway take-off length, airport altitude and temperature, max. permissible take-off weight, diversion airport and distance from destination, cruising altitude and temperature and wind speed. It then indicates the time of journey, fuel weight used, fuel reserve required, fuel required, take-off weight, usable payload, limiting payload, number of passengers, block speed, block fuel and operating cost.

The Invisible Bomber

FOR some time there have been stories in circulation about an incident in which a single U.S. jet bomber flew right through, and caused damage in, a bomber formation without any of the crew of the latter seeing or knowing what had hit them.

The Flight Safety Foundation, in its *Accident Prevention Bulletin* (58-4) gives a version of the events which, the bulletin says, is from an "authentic source." Here it is:—

The pilot of a jet bomber was flying at 30,000 ft. on a clear morning. He made a slow turn and was startled to see three other bombers approximately one mile away and on a collision course with him. Before he could react or alter the course of his aircraft, he shot through the formation, missing the nose of the first aircraft, flying under the second and over the third. As he went over the third bomber one of his engines struck the upper part of this bomber's tail and knocked it off.

The pilot who flew through the formation then returned to his home base, landed, and recounted his experience. Inasmuch as no report had been received from the formation he had flown through, it was called and requested to land. When it landed it was found that the formation consisted not of three aircraft but of six. The aircraft whose tail had been hit was not significantly damaged. What is amazing is that neither the pilot, the co-pilot, nor the observer in any of the six aircraft had seen the other bomber fly through the formation.

ETAPE 1		DIST. ETAP. 2	LONG. PISTE 3	ALT. AIRPT 4	TEMP. AIRPT 5	DECOL. MAX. 6	DEROUTEMENT 7		DIST. DERT. 8	TEMP. EN VOL 9	CROIS. 10	VIT. VERT 11	TEMPS VOL 12	FUEL VOL 13	RESV. 14	FUEL EMB. 15	POIDS DECOL. 16	CHAR. PAYA. 17	LIMI. CHAR. 18	NB. PAS 19	VIT. BLOC 20	FUEL BLOC 21	PRIX PAX 22	
		NM	FT	FT	C	LB			NM		FT	KT	H MN	LB	LB	LB	LB	LB			KT	LB		
GENEVA DUSSELDORF	1	394	12450	1410	+24	108000	HAMBOURG		184	ISA+15	30000.	0	0.59	5920	9700	16020	98100.	18250	CAP	80	249	7320	0.	17 1 1
	2									ISA+15	30000.	-33	1. 5	6440	9750	16560	98640.	18250	CAP	80	232	7840	0.	17 1 1
DUSSELDORF GENEVA	1	394	8110	193	+36	102200.	ZURICH		195	ISA+15	30000.	0	0.59	5060	9410	15280	93280.	18250	CAP	80	246	7300	0.	17 2 1
	2									ISA+15	30000.	-33	1. 5	6510	9860	15760	93920.	18250	CAP	80	231	7900	0.	17 2 1
LONDON PRAGUE	1	564	9630	85	+22	110000	VIENNA		140	ISA+15	30000.	0	1.39	6630	9230	19260	99360.	18250	CAP	80	308	11030	0.	18 1 1
	2									ISA+15	30000.	-5	1.39	6740	9230	19390	99660.	18250	CAP	80	301	11140	0.	18 1 1

Examples of flight plans produced by a computer for three operations by the Caravelle in typical conditions and assuming suitable diversion airports (columns 7 and 8).

R.A.F. States its Case

EVEN by the time this issue of THE AEROPLANE appears it is unlikely that the furore that has arisen over the R.A.F. exercise "Prospect II" will have died down. We do not propose to discuss the reasons for the uproar here, some brief comment will be found in our editorial. Nor can one give in full, as we should like, the text of the various spoken items. However, it should be possible to present *in extenso* certain salient points.

The exercise, which was held in London, took the form of a conference to which some 300 guests accepted invitations. They included H.R.H. the Prince Philip and his uncle, the First Sea Lord, Admiral of the Fleet the Earl Mountbatten. Mr. Duncan Sandys, Minister of Defence, had accepted an invitation but did not attend. Mr. George Ward, Secretary of State for Air, was absent in South America.

The guests were first addressed by the Chief of the Air Staff, Marshal of the R.A.F. Sir Dermot Boyle. The tone of the conference was set by his remark:

> "Why have we invited you all here today? Simply because there has been, and still is, great confusion in many people's minds about the rôle of the Royal Air Force both now and in the future. We feel that this confusion is bad for the country and for the Service, and since we are quite clear in our minds what our responsibilities are and how we are going to meet them, we feel that nothing but good can come from telling you what we think and having the benefit of your comments and your interest.
>
> "I wish to make it clear that today we are not attempting to sell the Air Force at the expense of either of the other Services. But since we are a relatively new Service—only 40 years old this year—and since we automatically deal in advanced techniques and consequently advanced forms of thinking, it is very difficult for the public to understand what we are about unless they are told."

He was followed by the Vice-Chief of the Air Staff, Air Marshal E. C. Hudleston.

The guests were then presented with a series of well-staged scenes. The first of these showed Air Commodore F. E. Rosier, who is Director of Plans in the Air Ministry, being interviewed by a committee of three M.P.s. This item was interesting, but involved political considerations, and more particularly moral considerations, about the use of the H-bomb. Consequently, in the subsequent discussion when the guests were invited to express their views, there was considerable airing of opposing opinions.

The next item was a scene involving the Director of Operations (B and R), the Air Commodore responsible for Operations in Fighter Command, the Group Captain, Plans, Bomber Command, and Deputy Director, Guided Weapons (A). The discussion was completely technical or military and most revealing. It was designed to emphasize that the efficacy of the deterrent is dependent upon the adequate protection of the bomber bases by Fighter Command.

The work of the Overseas Commands, pretty familiar to most readers of THE AEROPLANE, was discussed between Air Commodore Rosier and a defence correspondent. It was in the subsequent discussion that Mr. Eric Rylands made a statesmanlike case for the Merchant Air Fleet.

Then came the extremely instructive survey by A.C.A.S. (O.R.) Air Marshal Kyle of the equipment requirements of the R.A.F. This follows virtually in full.

Two key factors affect deterrent forces. First, the force must be seen by the Russians to be able to penetrate their defences; and second, the Russians must not think they can destroy a large part of it on the ground.

The spearhead of the deterrent today is the V-bomber force, equipped with Valiants, Vulcans and Victors. The weapon is the free falling nuclear bomb. These aircraft have a performance superior to that of their American counterparts, certainly when it comes to penetrating enemy defences. We are quite satisfied that this force is capable of fulfilling its task now.

Defences can be built up to reduce bomber effectiveness and we must counter by continually improving performance and efficiency. We shall do this by introducing the powered guided bomb; and by equipping the force with a complete range of electronic counter-measures. Both these measures will present the enemy with a vastly increased problem of countering the main bomber force. The first extends the perimeter from which the manned aircraft can attack, and will present the enemy with a small and very difficult target in the areas where he is most likely to concentrate his defences. The second, that is electronic counter-measures, greatly reduces the efficiency of the defence organization including his radars, communications and the like, and is in effect a form of defensive armament.

In parallel with this, and following a little behind in time, we are developing with the greatest urgency our own ballistic missile. This has a range of 2,000 to 2,500 miles. Stored and launched from underground, it will be a very difficult target indeed.

We regard the V-bomber, with its guided bomb, and the ballistic missile as complementary one to the other. Together they will combine to present the enemy with a gigantic defence problem, which, even when the necessary techniques are known, will require him to go in for a vast development of new radars, weapons and control systems.

Defences against these weapons are bound to be developed in time. To keep the initiative we will need what will amount to a second generation of these manned and unmanned weapons, and they will continue to be complementary.

A manned vehicle, that is something retaining discretion, not tied to large and vulnerable airfields but still capable of delivering a weapon from outside the enemy's perimeter defences; and a ballistic missile capable of being deployed and launched without the inflexible fixed ground organization required now, may provide the answer.

We regard the air defence force as an essential part of the deterrent force. Without it the enemy may be tempted into thinking he can knock out our offensive forces without risk of failure.

At present the active part of this defence is provided by fighters: Hunters and Javelins in service now, with the P.1 coming along soon. Both Javelins and the P.1 will be armed with the air-to-air homing missile Firestreak, so that there is a near certainty of a kill provided the aircraft can get within range of the target.

Our Effective Counter

We will add to the effectiveness of these defences soon, when we get the first of our surface-to-air guided weapons. This is the Bristol Bloodhound and will be followed by a development of the English Electric Thunderbird. Both are homing weapons, and in their present form have high-explosive warheads. Against the manned threat to this country these air defences will, we think, provide an effective counter, certainly to the extent that the Russians could not possibly assume they could knock out our deterrent forces with manned aircraft before we had time to go into action.

The most important improvement in defence will come with the introduction of a nuclear warhead for surface-to-air guided missiles, and possibly air-to-air weapons as well. Not only do we get a much more powerful defence against manned aircraft, but this will provide the possibility of some degree of defence against the ballistic missile. A proper exploitation of interdependence, particularly between ourselves and the Americans, could well produce spectacular results.

A year ago it was officially announced that we would not develop another fighter. Circumstances change fairly rapidly though, and if we do find a reliable defence against the ballistic missile, we could easily have a changed threat which would call for a long-range fighter designed to intercept, identify, and destroy beyond the practical range of surface-to-air guided weapons. At least we must think about this.

Strategic transport are necessary for reinforcing our overseas theatres, either with detachments of our U.K.-based Air Forces —bombers and fighters—or as is more usual—with Army reinforcements. And they are also needed to provide for air supply, airborne operations, and movement within a theatre, when this is needed on a large scale.

Civil aircraft are coming along which will serve perfectly well as replacements for the Britannia and Comet. These will deal with the personnel and light freight carrier.

The large freighter is more difficult. The problem is linked to the debatable question of stockpiling large and expensive equipment overseas. If this is acceptable, we can manage with a freighter with a relatively short-range when carrying full payload, provided it has a good ferry range. If the heavy equipment is designed for air transportability, that is capable of being broken down in smallish packages, we might even get away with an aircraft smaller than the Beverley.

The attraction of this is that we could probably have more of them, and base them in sufficient numbers where they are

more required, that is in the overseas theatres. It is in this field too that we may be able to exploit vertical take-off.

However, stockpiling is not all that easy. There is a strong case for a long-range large freighter for this and other fairly obvious reasons. If this is accepted we must make a start now and develop a military long-range transport which at the present moment seems to have no place in the civil inventory.

The rapid movement of troops close to their tactical operational positions demands the use of helicopters and short-range transport aircraft. We have the Bristol 192 general purpose aircraft coming along, and we have a requirement to replace the existing Whirlwinds and Sycamores. It is likely that we can accept one of the several types already being developed.

Tactical/strike aircraft are required first and foremost to support our Alliances, particularly N.A.T.O. and Baghdad Pacts. The job is at present being done by the Canberra and good though it is, quite clearly we will need a replacement. This will have to operate against modern and well organized defences and act as a sanction against the outbreak of local aggression or as a means of preventing its expansion.

For reasons of economy in development and in operational effort it is essential that this aircraft has the greatest possible flexibility. It must combine very high performance with the ability to operate from restricted airfields. We must exploit the latest developments in navigation, bombing and reconnaissance equipment to give it an all embracing capability as a strike/reconnaissance aircraft in all weather conditions.

Bearing in mind that it will be in service during the 1965/1970 era we intend to exploit to the full an aircraft of high speed at low altitude with a supersonic capability at high altitude. In view of the opposition it will have to compete with, it must have the best possible performance it can be given with our present technical knowledge. All we need now is the all-clear to go ahead and develop it.

It is almost a tradition that we have used fighter aircraft well tried in the U.K. to meet our ground attack, defence, and tactical reconnaissance needs overseas. This has worked well until now and has, of course, been economical. However, modern high-performance interceptor fighters are becoming less and less suitable for this general-purpose rôle. They have become too specialized and require large airfields and facilities which are not always easy to provide in the right place overseas. Their running costs are also very high.

All this could force us into equipping ourselves with a new type for this limited policing requirement—something which is simpler, more versatile, and more economical than the modern interceptor. We have arranged some trials in Aden to decide.

As regards air defence overseas our policy has been to provide the nucleus of a ground organization including early warning and the control radars, which cannot be set up in a hurry. We have only deployed the minimum number of fighter aircraft in order to exercise this organization and provide the minimum peacetime garrison force. I see no reason whatsoever to change this policy, even with the introduction of S.A.G.W. That is, we will still need to deploy the minimum ground organization peculiar to guided weapons and the need will continue, to allow for rapid reinforcement from the U.K., whether it be to augment the manned fighter force or an S.A.G.W. system.

It is quite certain that we will be unable to develop specialized aircraft or equipment to meet air defence commitments overseas.

Finally, may I emphasize the importance we attach to the widest possible research and development programme, not necessarily related to specific operational requirements. We cannot afford not to invest in research. We must make the resources available, even if it means sacrifices in front-line strength.

The last two items concerned manpower and finance. Both were extremely well done. Mr. Roberts, the Director of Manning, produced fairly encouraging evidence that the 11,000 volunteers required on 11-year engagements to maintain the strength of the R.A.F. at 120,000 regular ground airmen would be forthcoming by 1963.

The last item was a survey of the finances of the R.A.F. by Mr. R. H. Melville, Deputy Under-Secretary. His address, "Facing the Future—Finance," was notable for the extreme clarity of its presentation and the striking charts. What a pity that similar charts cannot accompany the annual memorandum circulated by the Air Ministry at the time of the Estimates.

The Lords and the R.A.F.'s Prospects

ONE day later than R.A.F. exercise "Prospect II," that is on May 7, the Air Estimates were debated in the House of Lords. The proceedings which lasted for more than three and a half hours were of especial interest considered in the light of the previous day's conference staged by the R.A.F. Noticeable pressure was put on the Government to make a statement about the continuance of the manned aircraft and in particular the supersonic bomber.

LORD BALFOUR OF INCHRYE rejected absolutely the concept that we should leave it to the United States. "There is always the possibility," he said, "that the United States and ourselves will not see eye to eye on dangers which confront us in Western Europe. . . ." Later, he said: "I believe it cannot be too widely known both inside and outside the Royal Air Force that for an indefinite number of years stretching ahead the large requirement for manned aircraft, both bombers and fighters, will continue."

And he set out his reasons why. A manned fighter is needed to interrogate an unidentified aircraft approaching these shores. In support of the manned bomber is its flexibility; in addition it allows time for consideration in a crisis of the political position which the intercontinental missile does not. The V-bomber force can patrol up and down the loiter line while the "high-powered statesmen of the World communicate with each other." He also pointed out that until mid-1960 "when the Thor missile is likely to become independent of the United States, we shall be virtually in the hands of the U.S. as regards control of the warhead."

LORD OGMORE pressed for information about the future of the manned bomber and fighter. He did not agree that Transport Command had reached its peak and said that it needed a good deal more aircraft. He referred to the failure in the Memorandum (which accompanied the Air Estimates) to deal with helicopters and their successors, vertical take-off aircraft. Little interest had been taken in development of such things. He said the Army Air Corps had had to go to France for a suitable helicopter and were trying out the S.E. Alouette.

Coming back to supply aircraft he believed it was dangerous to rely on charter firms for aircraft for lifting either troops or material and asked for Transport Command to be developed to a much greater extent. He asked for attention to be given to the Fairey Rotodyne.

VISCOUNT DE L'ISLE made the point that without military pressures we should not have been forced into the nuclear age and to the construction of long-range aircraft. "We owe our whole position in the World today," he said, "which is very fine, in these fields of power and air transport to the compulsions of defence."

THE EARL OF GOSFORD (speaking for the Government) pointed out that refuelling trials are now being planned for the Victor and Vulcan. He also disclosed that the industry has been invited to submit proposals for a successor to the Canberra for strike and reconnaissance rôles in overseas theatres.

LORD TEDDER remarked that there is scarcely a single aspect of science or technology where there has been a big advance where one cannot say that it was directly due to some defence contract or another. Pointing out that Mark II Victors and Vulcans were but improved versions of existing aircraft, he thought that if there were to be a follow-up of the present Victors and Vulcans nothing but a supersonic bomber could be envisaged.

"Now," he said, "if there is to be no supersonic bomber, it is clear to my mind that within quite a short period there is going to be no future bomber. Within quite a short period we shall have no bomber except an obsolescent one. What is more," he went on, "there will be an immediate effect on civil development."

LORD WINSTER suggested that it is not always realized that all developments in engineering generally spring from aeronautical engineering. If our aircraft industry suffers a setback due to diminution of military orders, our national engineering industry will also be set back in progress, in development and new techniques, and in that event our World status will be increasingly diminished.

It is essential to progress that the Government should give an estimate of future military aircraft requirements and of future missile requirements, and state what they are prepared to do about research and development. He spoke up on behalf of the charter companies which should be enabled to keep their fleets up to date.

THE EARL OF SWINTON asked the Minister to say whether it is now time to decide that there should be research into a further fighter and into a supersonic bomber.

New Equipment for the R.C.A.F.

WHEN the Maritime Air Command of the Royal Canadian Air Force formally receives its first three Canadian Argus long-range maritime-reconnaissance aircraft as the nucleus of the initial squadron re-equipment, a significant step forward in Canadian post-War Service aviation will have been taken. This ceremony has, in fact, been scheduled for this week-end at Greenwood, Nova Scotia, when the Chief of the Air Staff of the R.C.A.F., Air Marshal H. L. Campbell, C.B.E., C.D., is expected to hand over to the A.O.C. of Maritime Air Command, Air Cdre. M. Costello, C.B.E., C.D., the Command's third Argus. The first was delivered on April 30, the second on May 7, and the third is to carry the C.A.S. and other distinguished guests to Greenwood for the ceremony on May 17.

These three aircraft are to go to No. 405 Squadron (C.O., Wg. Cdr. J. C. Mulvihill, A.F.C., C.D.) which is based at Greenwood and with succeeding deliveries will progressively replace the Neptunes that the Squadron now has. In turn the Neptunes will be transferred to the M.A.C. station at Comox, British Columbia, where they will replace the Lancasters which are being drawn out of service.

Anti-submarine search and patrol is a most important part of the duties of any air force charged with the defence of a country with extensive sea approaches; and in this respect Canada's requirements are as stringent as those of any other maritime nation. These matters were fully recognized in 1954 when a contract was awarded to Canadair for a specialist long-range maritime-reconnaissance aircraft adapted from the Bristol Britannia turboprop airliner.

With the Canadair type number CL-28, R.C.A.F. designation CP-107, and type-name Argus, this aircraft retains the principal structural and aerodynamic features of the Britannia, but has been re-engined and extensively modified to suit its specialized rôle. For example, the mainplane, tail unit, undercarriage and primary flight controls are to all intents and purposes—except for small detail changes necessary to permit manufacture from materials available in Canada—the same as those in the British aircraft. On the wing, inboard of the ailerons, small spoilers have been fitted on the surface in order to give the high rate of roll at low altitudes that is necessary when attacking a submarine.

In the case of the fuselage, this is now unpressurized and has been structurally altered to accommodate bomb-bays forward and aft of the wing centre-section. The front fuselage has also been modified considerably to provide an observation or low-level bombing station, a new forward crew compartment and a large "chin" radome for the search radar.

As the principal requirement for this sort of aircraft is long-range operation at very low altitudes, the turboprop powerplant does not show to particular advantage by reason of its comparatively high fuel consumption under such conditions. For the Argus, then, it was decided to replace the Britannia's Proteus turboprop engines by four 3,700-b.h.p. Wright Turbo Compound radial piston engines. With the Argus' maximum fuel load of 6,800 Imp. gal. a maximum endurance of no less than 24 hours is possible—at reconnaissance altitude and speed. The aircraft cruises at 175-200 m.p.h. and has a range of more than 4,000 miles.

Fifteen crew members are carried in the Argus—three pilots, three navigators, two flight engineers, and seven communications and electronics operators. Specialist equipment includes a variety of the most up-to-date anti-submarine weapons and stores and 21 radio and radar installations. These last-named include the nose search radar; a magnetic airborne detector installed in the "sting" tail cone; and navigation and tactical air control equipment specially developed for the Argus.

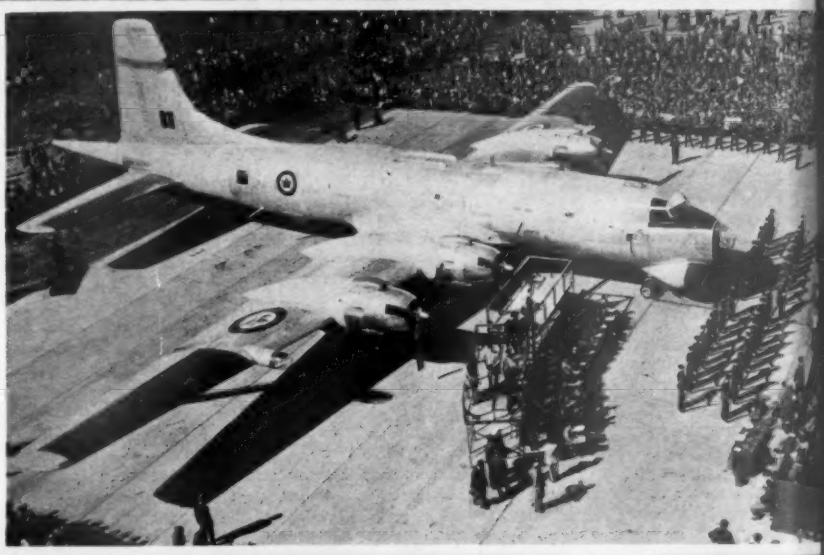
The contract for the development of this new aircraft for the R.C.A.F. was given to Canadair, Ltd., in April, 1954, and from that time on progress has been made with the characteristic hustle and efficiency that one has come to expect from the Canadair team. Design work started at once and the first drawings were released to the shops in July of the same year. The first aircraft was rolled out of the door on December 21, 1956, and its first flight took place on March 28 the following year. In September, 1957, the R.C.A.F. accepted its first Argus. And now the aircraft is in squadron service with Maritime Air Command.

Production of the Argus is now firmly under way but, as is usual with new Service aircraft, the total number involved has not been revealed. Altogether 10 aircraft are in fact flying at the present time, including the three at Greenwood. The remaining seven are engaged in various development and experimental programmes both with Canadair and with units of the R.C.A.F.

Phases of the development programme that have been completed to date are the contractors' and the R.C.A.F.'s preliminary assessment of airworthiness and equipment functioning; and the "structural integrity" testing. Current work includes a programme of 500 flying hours associated with design refinements and development; cold- and hot-weather trials by the R.C.A.F.'s Central and Experimental Proving Establishment (C.E.P.E.) Climatic Detachment at Namao, Alberta; weapons system evaluation; and telecommunications, radar and electronics systems evaluation.

Outstanding test programmes are the final performance and handling trials; intensive flying trials; and operational suitability trials. The first of these will be done by C.E.P.E. at Uplands, Ottawa, and the last two by Maritime Air Command.

As we have said, now that the Argus is coming into squadron service a new phase in the R.C.A.F.'s affairs is being opened. Indeed, from now on there will be a steady expansion—in range and striking power—of Canada's military maritime-reconnaissance facilities. Moreover, the Argus has the distinction not only of being one of the best equipped long-range anti-submarine aircraft coming into service anywhere in the World, but with a span of 142 ft. 3½ in. and an all-up weight of 148,000 lb. it is the largest aircraft ever to be built in Canada.

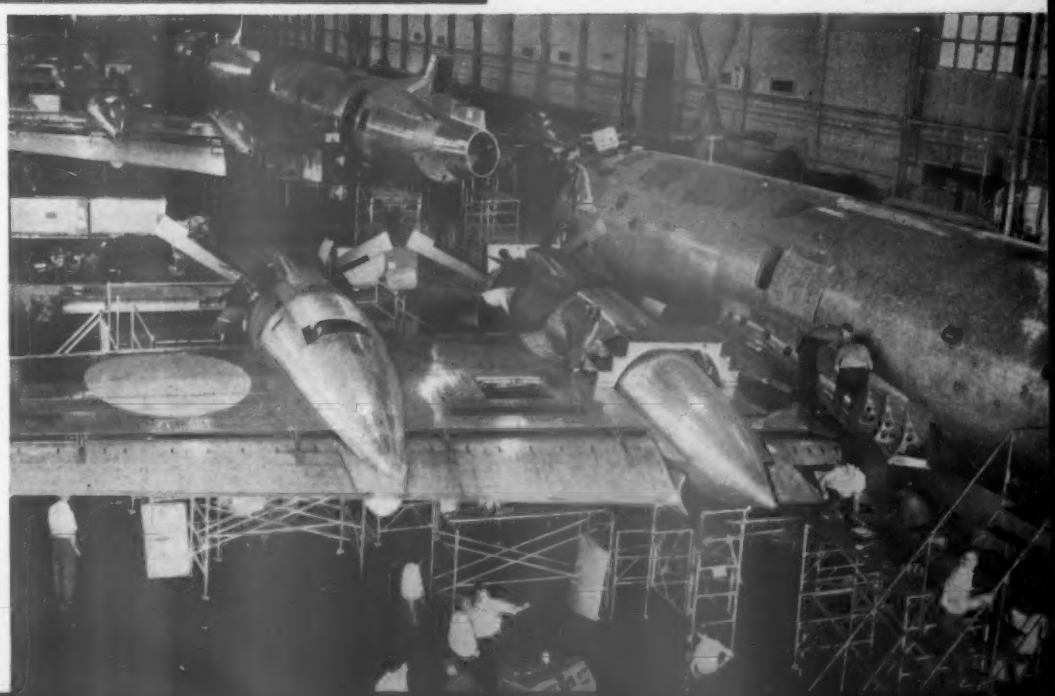


Now in service with No. 405 Sqn. of the R.C.A.F.'s Maritime Air Command, the Canadair Argus long-range maritime reconnaissance and anti-submarine aircraft has been derived from the Bristol Britannia airliner; it has, however, an extensively modified fuselage and has been re-engined with Wright Turbo Compound radial engines to suit the special requirement of long endurance at low altitude. Right, the first Argus was handed over to the R.C.A.F. last September.

For Seeking and Destroying

Above, the Argus is in production at Montreal and here is a section of the final assembly line. In the photograph on the left, note the two large dielectric panels at the wing tips; the Argus carries extensive and comprehensive radio and radar equipment.

Below, another view of the Argus production line at Montreal; no precise figures have been announced regarding the number ordered for the R.C.A.F. but the aircraft has been officially described as being in quantity production. The Argus carries a crew of 15 and has an endurance under reconnaissance conditions of 24 hours.



Left, the prototype Canadair CL-28 Argus aircraft together with the latest machine to be handed over to 405 Sqn., at the company's Montreal plant. The tail "sting" is a characteristic feature of modern anti-submarine aircraft and houses magnetic airborne detection equipment.

Strategic Reconnaissance

AS one of the major sources of intelligence information, the United Kingdom Reconnaissance Force has, with the advent of the V-bomber and the nuclear weapon, become an extremely important factor in the overall effectiveness and operational efficiency of Bomber Command's deterrent against a future World war. This Force has been planned and equipped as a strategic component of the R.A.F., which, in the event of nuclear warfare, could be used for long-range tactical reconnaissance as the existing tactical-reconnaissance aircraft lack the range or navigational ability to penetrate to probable tactical targets.

To centralize the control of all strategic-reconnaissance units under one small but specialized headquarters staff, the Central Reconnaissance Establishment (C.R.E.) was formed in April, 1957, under the command of Air Cdre. D. S. Radford, C.B., D.S.O., D.F.C., A.F.C. The Force is functionally controlled by the Ministry of Defence through the Air Ministry and C.R.E. to the operational squadrons. Its tasks are allocated by the Joint Air Reconnaissance Intelligence Board (J.A.R.I.B.).

Operational control and the reconnaissance policy is made by the Director of Bomber and Reconnaissance Operations at the Air Ministry through Headquarters, Bomber Command, and No. 3 Group at Mildenhall, to the squadrons.

Catering for all three Services and for various Government departments and intelligence agencies, the Force consists of the P.R. squadrons themselves, together with the ground organization responsible for the processing and interpretation of aerial photography. These units include No. 58 Squadron (Wg. Cdr. C. M. Fell) equipped with Canberra PR.7s, and No. 543 Squadron (Wg. Cdr. R. A. S. Berry, D.S.O., O.B.E., D.F.C.) operating Valiant B(PR)K.1s, the permanent processing and interpretation teams, and the Joint Air Reconnaissance Intelligence Centre (J.A.R.I.C.).

SOUTH COAST VISTA.—This photograph covers the south coast of England from Worthing to Beachy Head and Dungeness. It was taken from above 45,000 ft. by a Valiant B(PR)K.1 of No. 543 Squadron.

A joint Service interpretation organization sponsored by the Air Ministry on behalf of the three Services, J.A.R.I.C. is commanded by an Army officer, Lt.-Col. I. H. Murray, M.C., of the Highland Light Infantry, and each Service is responsible for making its own contribution to an agreed establishment. Its prime responsibility is air photography and the distribution of reports, a science which was pioneered and perfected by the R.A.F. in the 1939-45 War and which was by far the most prolific intelligence medium available to the Allies. J.A.R.I.C. comprises the central print and negative libraries, the Joint School of Photographic Interpretation, the first, second and third phase interpretation teams, and a model section.

Interpretation consists of the detailed and systematic examination of vertical and oblique photographs which are usually taken as stereo pairs and examined under a stereoscope to give a three-dimensional picture with magnified detail. Vertical photographs have the advantages of showing a plan view of constant scale without dead ground, and can therefore be laid as a mosaic. Oblique photographs, on the other hand, have the disadvantages that any ground behind the target is dead; comparison with maps is difficult, because of the changes in scale, and the quality of the result varies with the angle of the shot.

Semi-vertical photographs, such as those taken by the fan of cameras in a Canberra or Valiant, retain all the properties of a vertical shot, but the photographs of the outer cameras of the fan installation become difficult to scale and impossible to lay down as a mosaic. The scale of a vertical photographic or a mosaic can be calculated if the operating height of the P.R. aircraft and the focal length of the camera are known.

First-phase interpretation is usually undertaken at the airfield using negatives or wet prints to provide quick answers on targets of immediate operational interest. The next step, second phase interpretation, can be prepared within 24 hr. to provide detailed reports, and the third-phase work is designed to give all possible information on some specialist aspects, and is normally supported by annotated photographs.

In any future war this science will almost certainly be the only practicable means of getting up-to-date intelligence on the enemy. In peace time, opportunities for the interpretation of photographs of areas that might be important in war are more limited, but the organization is fully exercised on more routine tasks in preparation for war.

From this it can be seen that the rôle of the Reconnaissance Force in the event of war would include the photography of potential targets before attack to determine whether they have developed as targets; and post-strike cover of targets, to assess damage and confirm destruction. Other obvious tasks might be the seeking out of enemy naval units and the discovery of land-based and seaborne missile sites. Except for the case of limited hostilities, the 1939-45 techniques involving the photography of larger areas over and over again is now outdated; the current requirement is to cover specific targets with the minimum number of photographs so that processing and interpretation teams can meet the stringent time scale imposed by global war conditions.

The Recce Task

The base of two of the United Kingdom P.R. squadrons and their supporting units is R.A.F. Wyton, under the command of Gp. Capt. E. G. Jones, C.B.E., D.S.O., D.F.C. Since 1945 the station has been the base for Bomber Command Lancasters and Lincoln squadrons, and between 1951 and 1952 it was a U.S.A.F. airfield.

Flying units of the R.A.F.—in the form of three Canberra

(*Continued on page 685*)

(*Continued from page* 684)

P.R. squadrons—returned to Wyton in January, 1953, and the new buildings to house the Photograph Processing Squadron were constructed. During the same year Canberras from Wyton flew the films of the Coronation of H.M. the Queen across the Atlantic so that they were being shown in Canada only 8 hr. after the event. The R.A.F. team for the 1953 New Zealand Air Race was trained at the station.

The main users of strategic intelligence gained from reconnaissance are the Ministry of Defence and the planning staffs of the three Services, and to provide training for this war rôle the Force is exercised in various peacetime tasks of a highly productive nature. These cover survey work in the United Kingdom, Middle East and Far Eastern theatres, up-to-date cover of airfields and special tasks for the Army such as camouflage exercises.

Having moved to Wyton from Benson in 1953, No. 58 Squadron operates its Canberras on high and low reconnaissance missions and is employed in the reinforcement of M.E.A.F. (Canberras) and F.E.A.F. (Meteor PR.10s and Pembrokes) reconnaissance squadrons for special tasks. But the Squadron's greatest commitment for the past two years has been in connection with Operation "Grapple"—the nuclear and thermo-nuclear weapons tests at Christmas Island in the Central Pacific. This has involved upper-wind finding and complete meteorological reconnaissance flights before a nuclear test, and transporting samples of radioactive fall-out to the United Kingdom within 24 hr. of the test.

Training for the meteorological-reconnaissance rôle involves special long-range navigation sorties over the sea, in all conditions of sea state, and training programmes to produce a very high degree of navigational accuracy over long sorties. There is no GEE coverage at Christmas Island and the only ground navigation aid is a radio beacon, so the navigator is restricted to the Canberra's Doppler navigation installation and astro-navigation.

For the low-level rôle in the PR.7 the navigator remains in his ejection seat and gives the pilot, with the aid of a time-and-distance log and the Doppler navigation equipment, a running commentary of the track which should be flown with possible land marks ahead of the aircraft. The pilot, in his turn, acts as the navigator's "eyes" and passes him information to maintain the correct track.

Radar Photographs

Formed in the middle of 1955 as the second Valiant squadron, No. 543 with its B(PR)K1s undertakes many tasks similar to those of No. 58 Squadron, but in addition has a radar reconnaissance capability. This involves the photographing of the aircraft cathode-ray tube (C.R.T.) presentation with a 35-mm. camera and has immense possibilities which are being developed by C.R.E. Radar reconnaissance is equally effective by day or night, and is unaffected by cloud except for heavy cumulo-nimbus which shows up on the C.R.T. and has a shadow area behind it from which there are no radar reflections.

From about 1942, airborne radar has been fundamental in the detection of ships and submarine periscopes at sea. In late 1943 the R.A.F. took radar-scope photographs of German towns as they appeared on the screens of aircraft bombing radar, and this photography enabled navigational plotting charts to be constructed on which towns were represented as they would appear on the radar screen.

More recently vastly improved definition in radar pictures and faster films and camera lenses have enabled radar-scope photographs to be taken which can be electronically analysed using density-cutting and other techniques. This method of reconnaissance is still in its infancy and suffers, as does photographic reconnaissance, from processing and interpretation delays. On the credit side scale variation with distance from the aircraft can be corrected electronically.

It is probable that if radar is developed to produce results comparable with visual photography it will suffer interference from less dense cloud and perhaps from rain or snow. This interference is never likely to be so serious in its effect as that caused by cloud to visual photography. Radar reconnaissance requires the same very high standards of accuracy in flying as visual survey photography, and its development probably depends as much upon accurate flying as upon electronic advances. This may in itself limit its operational application.

The B.B.C. recently announced techniques for recording pictures received by television cameras as electronic impulses on magnetic tape. This technique might well be used to record the electronic impulses normally presented for photography as a picture on the C.R.T., thus eliminating processing delays and other purely photographic problems from radar reconnaissance.

One of No. 543 Squadron's present tasks, which is nearing completion, is the production of a radar mosaic of the entire United Kingdom. The standard P.R. equipment of a Valiant comprises a fan of semi-vertical cameras, one vertical camera for survey work, and a fan of three cameras for tri-metrogen photography.

Since 1955 training exercises and operational tasks completed by No. 543 Squadron include cold-weather flying trials in Canada during the winter of 1956-7, a survey of the Woomera rocket range in Australia for the M.o.S. during 1957, and detachments to M.E.A.F. and 2nd T.A.F. For detachments the Valiants and their aircrews are backed up and supported by groundcrew from Wyton, who are usually moved by Comets of Transport Command.

The majority of new crews posted to No. 543 Squadron are ex-P.R. personnel with at least one Canberra P.R. tour to their credit, and it takes approximately six months' training to bring them up to the operational standard of the squadron. The navigational problem with the photographic-reconnaissance work is to fly an extremely accurate track for some considerable distances, as opposed to flying to a given point for bombing.

Visual Reconnaissance

A third type of reconnaissance—visual—is practised by the two squadrons during exercise periods. In any future war, the urgency with which intelligence on a target might be required means that, in spite of advances in camera design and the possibilities of radar photography, visual reconnaissance remains of considerable and perhaps even of paramount importance, although there are severe limits to the accuracy and scope of cover obtainable visually.

Of equal importance to the operational squadrons at Wyton is the Photographic Processing Squadron responsible for the high-speed developing and printing of the films, and the production of prints. The procedure is that information of a sortie is obtained from the reconnaissance briefing and the completed mission in the form of films, with a report, is sent to the Processing Squadron on the return of the aircraft.

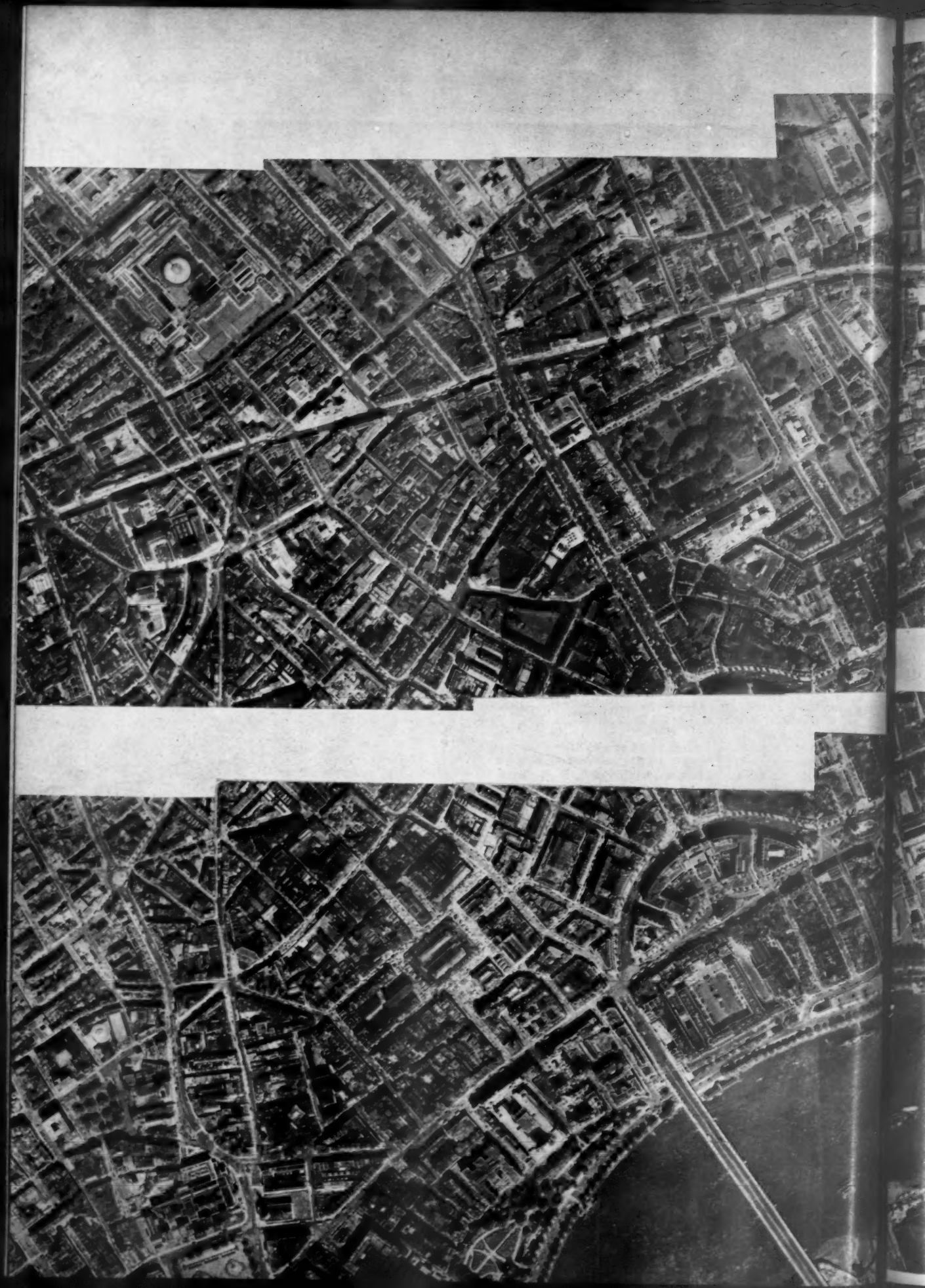
After the film has been developed in the continuous-film processing room it is taken for negative viewing and examined for camera magazine and processing faults. Print conditions are assessed and a titling strip is prepared. Each negative is numbered, the film is put through a multi-printer, and a plotting set of prints is produced from each film. After plotting the sortie is "Photostat-ed" and the film is sent to C.R.E. for second- and third-phase printing.

To maintain an adequate supply of crews for the United Kingdom, 2nd T.A.F., M.E.A.F. and other overseas Canberra reconnaissance squadrons, a P.R. training element is combined with Bomber Command's No. 231 Operational Conversion Unit for Canberra crews at R.A.F. Bassingbourn. Commanded by Sqn. Ldr. D. K. Miller, the aim of the P.R. Squadron at Bassingbourn is to produce a crew to operate P.R. aircraft, as opposed to a Canberra pilot and navigator, with enough knowledge on the mechanics of the cameras to undertake airborne rectification of snags and supervise ground repairs and maintenance away from base.

In the past, most pilots and navigators posted to the O.C.U. for Canberra conversion and training have been experienced P.R. crews, but inexperienced aircrew from F.T.S. and A.N.S. are now joining the 14-week course. The syllabus includes a total of 65 hr. flying involving Canberra instruction for pilot conversion on to type, generally handling sorties to build up air experience on the Canberra PR.3; navigation trips and instrument flying; a small amount of night flying, and photographic sorties.

Before the start of flying instruction crews receive four weeks' ground school on P.R. tactics and cameras in addition to general aircraft handling. To help in the former, a fault simulator for camera-failure correction and familiarization of photographic procedures is employed.—P.R.R.

(*Pictures on pages* 686-7)



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Strategic Reconnaissance

One of the main peacetime tasks of the Reconnaissance Force is survey work for United Kingdom and overseas requirements. Left, a mosaic of London from Seven Dials to Ludgate Circus by Canberra PR.7 of No. 58 Squadron showing the detail that can be obtained in medium-level photography. Below, a low-level oblique of Bedford also taken by a No. 58 Squadron Canberra.

Valiant—First of the V-bombers

WITH the advent of the nuclear bomb the function of the bomber aeroplane was changed completely because the size and weight of the bomb load became of secondary importance to the means of ensuring its delivery. The first British aircraft produced to deliver a nuclear bomb over medium ranges was the Vickers Valiant—the first of the V-bombers.

Design of the Valiant—the Vickers Type 660 was the prototype designation—proceeded under Mr. G. R. (now Sir George) Edwards, and assembly of the first aeroplane began at Wisley early in 1951. An order for 25 Valiants placed in April that year was followed by the first flight on May 18, 1951, with the late Capt. J. ("Mutt") Summers as first pilot and Mr. G. R. ("Jock") Bryce as co-pilot. In September the same year the Valiant displayed its ominously good-looking lines at the S.B.A.C. Show—being aptly described by one correspondent as resembling "a great aluminium shark." (An account of the history of the Valiant appeared in our issue for October 25, 1957.)

To extend its range over that given by internal tankage, underwing fuel tanks have been adopted and the Valiant can be refuelled in flight if need be. It can also be fitted out for photographic-reconnaissance work.

The Valiant in Detail

Electrics play a very big part in the systems and services of the Valiant, hydraulics being used only for main wheel brakes and nosewheel steering while pneumatics are used only for seal inflation of the pressure-cabin door and canopy. Each of the four Rolls-Royce Series 200 Avon turbojets drives a 22½-kW. DC generator for the 112-V DC system. Three 3-kW. rotary transformers supply power to the 28-V. DC system for all electrical system control lines and various other items of equipment. Backing up this generated electrical supply there are 96-V. and 24-V. batteries, the former charged by the generators and the latter by the transformers. The flying controls use 112 V.

Voltage is fully regulated with provision for load sharing between generators and transformers. An AC supply for flight instruments, radio and radar is provided by inverters — Type 350 inverters giving 1-kW. three-phase 400 c/s. at 115 V. and 2-kW. single-phase 1,600 c/s. at 115 V. for radar and radio, and Type 100A for the 115-V. AC 400 c/s. instruments supply. If the Type 100A should fail, one Type 350 inverter comes into use and if this fails another comes into operation.

Sir George R. Edwards.

There is also an inverter for the Doppler navigator equipment. Engine starting is done by electric motors built into the engines and this system has been trouble-free in service. The two batteries can be used in series to effect starting where no external power supply is available. Vickers had to devise their own ground supply trucks, as none was available.

Throughout the electrical system there is wide use of "positive and negative" switching to ensure that no circuits can be inadvertently energized by a stray positive fault. All major items of electrical equipment—generators, inverters and so on—are air-cooled. A high-voltage (112-V.) system was chosen because low voltage (28 -V.) is a much heavier installation and, in 1948, the AC system was neither proven nor acceptable in view of the time-scale required for delivery of the aircraft.

Control System

When manually operated, the control surfaces are moved by the push-pull rods, the power-control units not forming part of the run. When power control is selected, the continuity of the direct control runs between the pilot's controls and the surfaces is broken, the rods transmitting the pilot's movement to the power-control units, and the surfaces are moved by the power units through the remaining portion of the push-pull rod run. The pilot is thus completely isolated from external loads in the system. The power controls were developed by Boulton Paul Aircraft, Ltd., following work with the Tay Viscount.

Each of the three primary control circuits has its own power-control unit and an artificial "feel" unit. Trim tabs are electrically operated and there are geared balance tabs. Side-by-side dual controls are fitted in the cockpit.

Elevator and rudder power-control systems are built into one power pack, the aileron system having a separate unit. There are two hydraulic generators in each power pack, driven by separate electric motors. Cross-connections inside each unit allow it to be operated by the remaining hydraulic generator if one should fail, although the rate of movement is halved. If a further failure occurs the controls automatically revert to manual operation.

Should such a reversion occur, it is obviously essential that the pilot should be able to control the aircraft within safe

(*Continued on page* 689)

ROCKET BOOST.—As demonstrated at Farnborough, the Vickers Valiant makes good use of de Havilland Super Sprite rocket packs at take-off.

Photograph copyright "The Aeroplane"

(*Continued from page* 688)

limits and be able to restore any out-of-trim. Warning lights indicate the nose-up and nose-down trim limits, operated by a spring-link device in the elevator-control run.

The normal action of the pilot is to adjust the trim tab for the elevator and/or the variable-incidence tailplane until the aerodynamic load on the elevator is reduced to be within predetermined limits. Outside these limits the load affects the spring-link which operates either of the two lamps. One lamp indicates excessive load in the nose-up sense and the other indicates the limit of nose-down trim of the aircraft.

There are three sections of flap on each wing. The inboard sections are of the single-surface type because they follow the contours of the underside of the jet pipes. Outboard of these are two sections of double-slotted area-increasing flaps. Flap-angle setting is at the choice of the pilot and can be varied to suit conditions and loads carried. The flaps are screw-driven from bevel boxes by an electric motor driving through a gearbox. An emergency motor is provided to supply power in the event of a main motor failure. There are three sections of hinged air brakes on each wing, operated by a single motor-driven gearbox.

The crew cabin of the Valiant is fully pressurized and there is normal accommodation for five crew members—two pilots, two navigators and an air electronics officer. An additional "jump seat" is available, so that the maintenance crew chief can accompany the aircraft on trips to overseas bases.

The pressurized cabin extends from a bulkhead just ahead of the windscreen to another bulkhead to the rear of the canopy fairing. Two levels of pressurization are used, a 9 p.s.i. pressure differential for cruising flight and a 4½ p.s.i. differential for combat. The object of this is that the crew can enjoy full benefit from the system for most of the flight, changing over to the combat conditions and the use of oxygen when there is the possibility of enemy action damaging the pressure shell.

Small perforations of the shell can be plugged with leak-stoppers, but in the event of a large hole being made there is an emergency "flood flow" system whereby large quantities of engine compressor air are fed directly to the cabin.

EARLY MODEL.—This wind-tunnel model of the Valiant, made in 1948, shows how the shape has changed little from the original layout.

This "flood flow" system is automatically operated when the cabin altitude exceeds 29,000 ft., a pressure differential of 4.57 p.s.i., so that cabin pressure does not drop below the "combat" condition.

The incoming engine air must be cooled, however, and this is done by passing it through a heat exchanger which is cooled by ram air drawn in by a scoop that emerges from the port side of the fuselage into the airstream. This coolant air is then dumped back to atmosphere through a vent farther along the fuselage side.

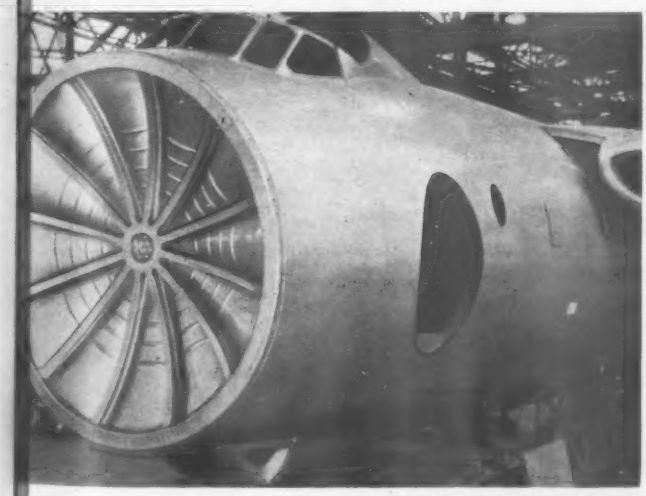
In the event of having to abandon the aeroplane in flight, the three rear-facing crew members leave first by the main entry doorway. The door is jettisoned and a protective "eye-lid" cowl gives some protection from the airflow as they bale out.

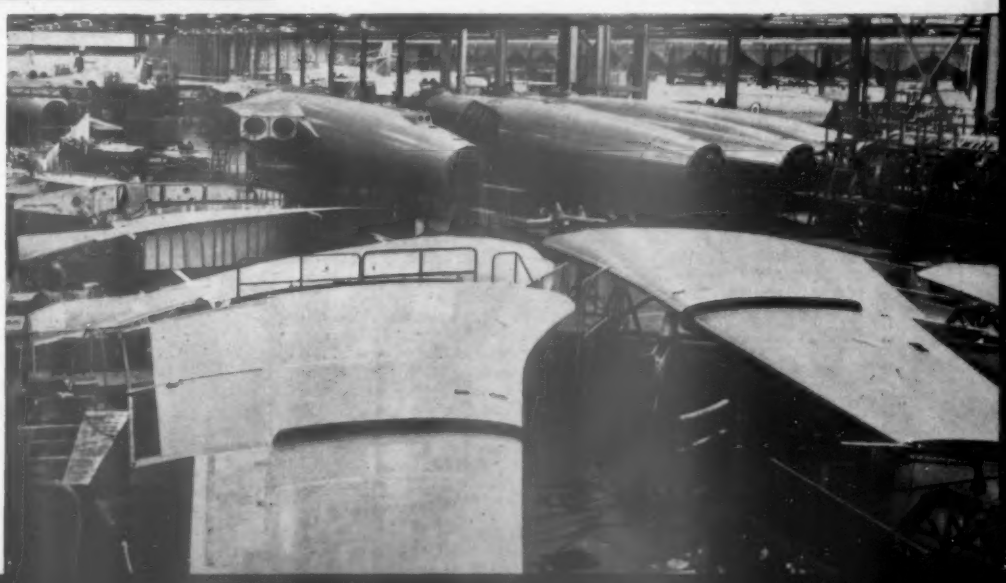
The two pilots leave by ejector seats (Martin-Baker Mk. 3A) after simultaneously firing the 26 explosive bolts retaining the canopy roof. When the handle firing these bolts is operated the elevator circuit is severed and the control wheels are flung forward so that the pilots are not obstructed when they eject themselves.

Normal cabin conditioning is connected to the airframe thermal de-icing system in that engine-compressor bleed air is used for both. When air temperature in the cabin exceeds that normally needed, it is reduced by passing the air through one or both stages of a two-stage cooling system, which incorporates an inter-cooler and a Godfrey cold-air unit.

Leading edges of wings, engine air intakes, tailplane and fin are thermally de-iced by hot air bled from the last stage of the engine compressors. After passing along ducts in the leading edge the air is vented to atmosphere through gauze-covered outlets near the tips of each flying surface.

Air temperature is regulated by admission of cold air drawn in through a flush-type intake under each mainplane and in

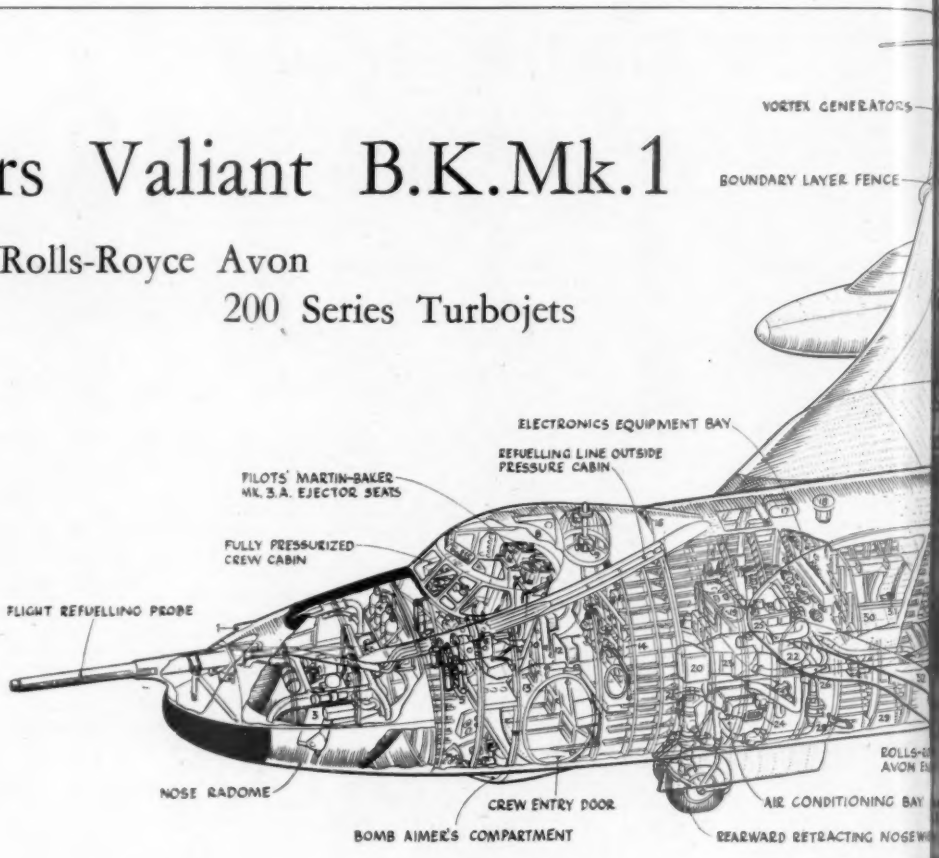




IN PRODUCTION.—Front end of the pressure cabin, above, is formed by a domed bulkhead stiffened by radial beams. Right, a view of the assembly lines at Weybridge.

Vickers Valiant B.K.Mk.1

Four Rolls-Royce Avon 200 Series Turbojets



Span, 114 ft. 4 in.; length, 108 ft. 3 in.;
loaded weight (reported), 120,000 lb.–150,000 lb.

the leading edge of the fin fillet just ahead of the air intake to the "feel" units.

Bomb-bay heating is by a tapping from the tail unit de-icing supply. Air is ducted to small circular diffusers within the bay and the supply is controlled by cockpit switches on the starboard console. Rubber-to-metal or metal-to-metal seals are used all around the bomb bay.

Pilots' and bomb aimer's windows have fluid de-icing supplied from separate tanks. Each pilot's windscreen has a wiper unit consisting of a wiper head, electrically driven hydraulic pump and rheostat control.

Undercarriage design—by Vickers—is unusual in that the two main units each consist of two large wheels in tandem, retracting outwards into the undersurfaces of the wings. The Valiant was a very early application of Dunlop Maxaret anti-skid braking, a most important feature for ensuring accurate pull-ups on short runways.

Engines, Fuel and Thrust Boosting

Originally powered by four Rolls-Royce Avon R.A.3 turbojets of 6,500-lb. static thrust and later fitted with the 7,500-lb. thrust Avon R.A.7, Valiants almost certainly now have the Avon R.A.28 Mk. 204 of 10,000-lb. thrust, the first British turbojet to pass a type-test with five-digit thrust (see THE AEROPLANE, October 11, 1957, for a description and cutaway drawing of the Avon 200 series engines).

Two Avons are buried in each wing root with spectacle-shaped intakes at the wing leading edges. Ducts from the intakes lead back to the engines, which are mounted in shrouds between front and rear spars of the inner wing. Each shroud is divided into two zones by a bulkhead, Zone 1 being the region of the compressor and Zone 2 that of the combustion system.

The two engine shrouds are separated by a rib between the wing spars which forms a mounting for the engine control-lever assembly. Passing out from the fuselage, the control rods run under the air intake forward of the front bulkhead and connect with lever groups which direct controls down the left-hand side of each engine to their connections on the fuel-control unit.

Each engine has its own fire-extinguisher system of (automatic resetting) fire-detector units, five spray rings and bottles of methyl bromide.

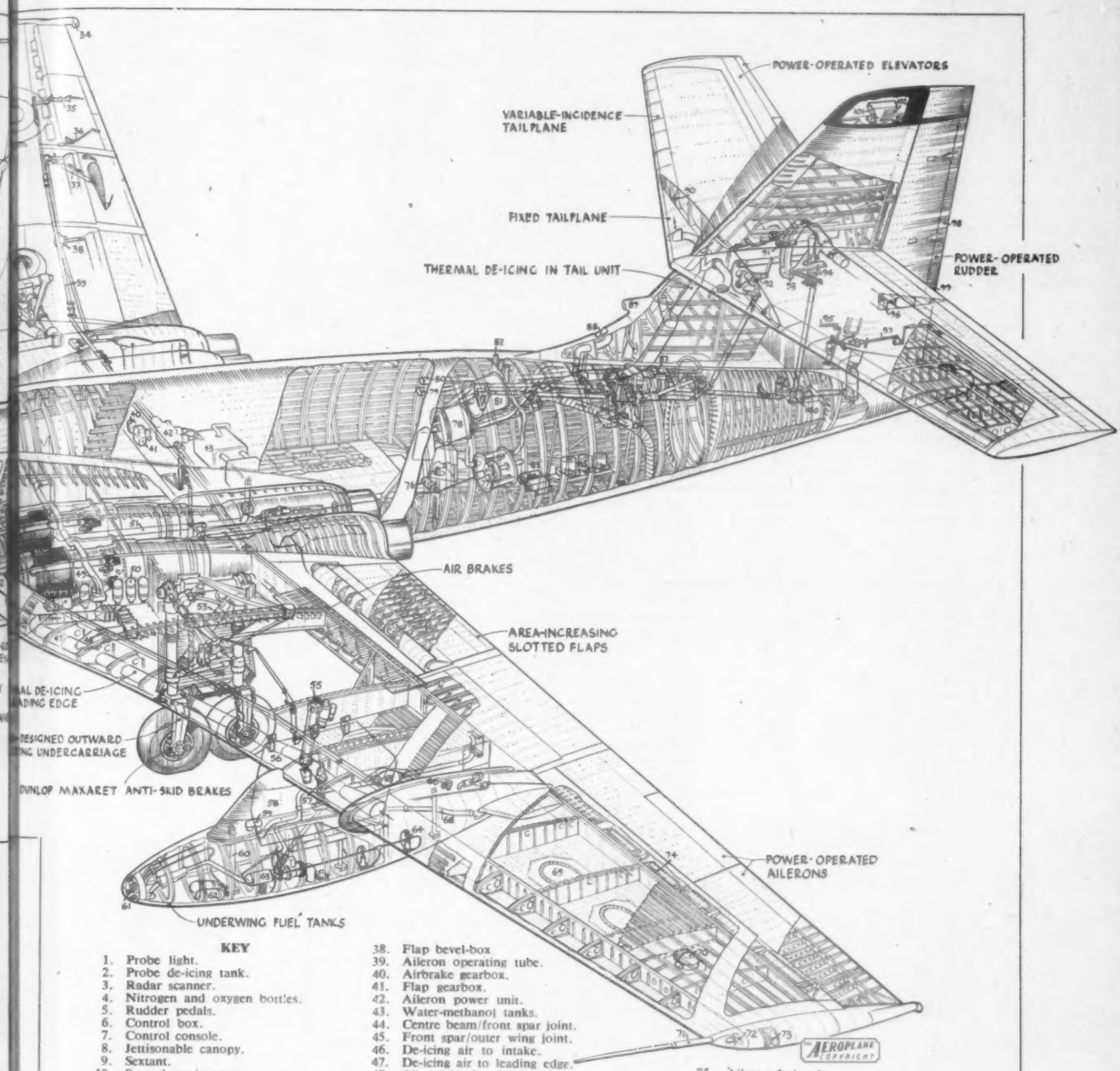
There are numerous bag-tanks for fuel, housed in the fuselage and the wing. Additionally, two large underwing tanks can be attached for long-range missions. This was envisaged from the start of the aircraft design. The total capacity can be increased by installation of a tank in the bomb bay when the Valiant is used for photographic reconnaissance or as a tanker.

This distribution of fuel around the airframe is for the very good reason of avoiding large losses should enemy action damage the airframe locally. Fuel is drawn from the various pressurized tank units by manually selected electrically operated pumps, aircraft c.g. being maintained by correct selection. A simple manual system was preferred to a "black-box" system of fuel-flow proportioning because it is simpler and could be produced quickly. In service, the manual system has proved the wisdom of this decision.

According to the payload, the amount of fuel carried is varied and is allocated to the tank units to maintain the correct trim.

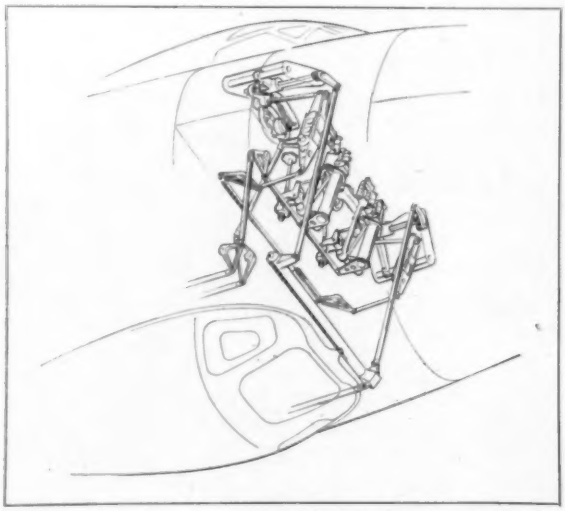
One of the first aeroplanes to have underwing pressure refuelling, the Valiant originally had four refuelling points—one under each wing and one on each side of the fuselage. Now that flight refuelling has been adopted the fuselage-side points only are used, and from these any tank in the aeroplane can be refilled under pressure.

Vickers did a lot of work in developing underwing pressure refuelling and evaluated suitable bowsers for the M.o.S. The Valiant was among the first aircraft made suitable for use with AVTAG wide-cut gasoline. Since the prototype had been used with kerosene fuel, the fuel-tank pressurization was



KEY

1. Probe light.
2. Probe de-icing tank.
3. Radar scanner.
4. Nitrogen and oxygen bottles.
5. Rudder pedals.
6. Control box.
7. Control console.
8. Jettisonable canopy.
9. Sextant.
10. Second navigator.
11. First navigator.
12. Electronics officer.
13. Exit "eyelid."
14. Navigation crate.
15. Lifting eye.
16. Dinghy stowage.
17. Nitrogen bottles.
18. Loop aerial.
19. Radar units.
20. Flood-flow cooler scoop.
21. Normal air supply to cabin.
22. Flood-flow air outlet.
23. Air cooler (flood-flow).
24. Air cooler (normal).
25. Air cooler inlet.
26. Inverter air inlet.
27. Ground ventilation fan.
28. Bomb-bay spoiler.
29. Bomb-bay wall.
30. Bomb-bay door.
31. Bomb-door mechanism.
32. Thermal de-iced intake.
33. Engine-bay vents.
34. Wing-tanks vent.
35. Aileron and tab mechanism.
36. Aileron trim-tab jack.
37. Flap tie-rod.
38. Flap bevel-box.
39. Aileron operating tube.
40. Airbrake gearbox.
41. Flap gearbox.
42. Aileron power unit.
43. Water-methanol tanks.
44. Centre beam/front spar joint.
45. Front spar/outer wing joint.
46. De-icing air to intake.
47. De-icing air to leading edge.
48. Air intake for de-icing.
49. Hot/cold-air valve.
50. Fire-extinguisher bottles.
51. Thermal de-icing duct.
52. Undercarriage actuator.
53. Undercarriage balance cylinder.
54. Undercarriage uplock.
55. Undercarriage-door actuator.
56. Undercarriage door.
57. Underwing tank link.
58. Underwing tank stalk.
59. Pressure-relief valve.
60. Pacitor tank unit.
61. Ground test connections.
62. Nitrogen bottles.
63. Fuel pump.
64. Fuel-jettison valve.
65. Refuelling cut-off valve.
66. Pressure-reducing valve.
67. Inward relief valve.
68. Vent pipe.
69. Wing tank-bay door.
70. Landing lamp.
71. Pitot-static head.
72. Navigation lamp.
73. I.L.S. localizer aerial (glide-path, starboard).
74. Aileron fabric seal units.
75. Aileron feel unit.
76. Bomb-bay deflector jack.
77. Aileron feel unit.
78. Elevator feel unit.
79. Fuel tanks vent pipe.
80. Thermal de-icing duct.
81. Rudder feel unit.
82. Air intake for feel units.
83. Rear-fuselage walk-way.
84. V.H.F. units.
85. Navigation equipment.
86. Rear entry hatch.
87. Rudder and elevator power units.
88. Air intake, tail de-icing.
89. Feel units ram air intake.
90. Tailplane hinges.
91. Elevator-locking mechanism.
92. Elevator-control compensator.
93. Elevator mass balance.
94. Tailplane screw-jack.
95. Rudder-locking mechanism.
96. Elevator fabric seal units.
97. Rudder trim-tab jack.
98. Rudder balance tab.
99. Rudder trim-tab.
100. Tailplane actuator.
101. V.H.F. and Gee aerials.
102. De-icing air outlet.



Drawings copyright "The Aeroplane."

VALIANT DETAILS.—Flying control linkages are shown above. Right, the basic load-carrying structure is a keel member above the bomb bay.

doubled to prevent the AVTAG boiling at operating heights. A nitrogen purging system is used, backed up by air pressure.

Fuel venting from the wings is through vent pipes at the tips. Fuselage fuel is vented through a large pipe which also comes into use as an overflow if the refuelling valves fail—either in flight or on the ground. A system of fuel heating is used to avoid the possibility of the fuel water-content freezing up the filters or the nitrogen valves.

Water-methanol is primarily supplied as a built-in system for restoring any power lost when operating in tropical conditions or from high plateau levels. It could also be used for slight thrust augmentation if the need arose. A one-shot system is used, as water-methanol is only for take-off. Although no flow rate may be quoted, the rate is very high, and the effect of using the system is to obtain a thrust increment of the order of improvement given by afterburning.

Right from the start the Valiant was designed to use rocket boosters and the de Havilland Super Sprite rocket pack was developed for this application. One Super Sprite pack is attached to each wing of the Valiant, under the engine bays. After take-off the rocket packs are released and return to earth by parachute for subsequent re-use.

In climatic conditions of maximum heat with a short runway, Super Sprites and water-methanol are both used. There are special operational techniques which have been devised so as to get the best advantage of the variations of thrust available, according to the conditions.

Aerodynamics and Shape

In layout the Valiant is not unusual, and the logic of its configuration is readily apparent. As noted earlier, the aerodynamic design was not intended to be revolutionary, and the sweepback is not very great. It has been reported that the maximum Mach number is about M=0.91 at 40,000 ft., a speed of 600 m.p.h. A range of 2,980 miles (with internal fuel only) and a service ceiling of 50,000 ft. have also been reported.

A large wing area—and reasonably low loading—was decreed by the requirements for good take-off performance from short runways and a long range. With such a wing the choice of buried rather than podded engines is logical. This being the case, the inner third of the wing is swept back at a larger angle than the outer planes because of the increased root thickness necessitated by the buried engines.

By increasing the chord in this region, a reasonable thickness/chord ratio of 12% is maintained at the roots—the outer planes are of 9% ratio—and the increased sweepback raises the local critical Mach number where airflow accelerating around the fuselage nose meets the wings.

A capacious bomb bay enforced the use of a shoulder-wing, and the tailplane had correspondingly to be placed up on the fin to escape the jet efflux. The horizontal tail surface is in three main units—a small fixed section of triangular shape, a large variable-incidence tailplane hinged from the fixed section, and the elevator with its trim tabs.

The amount of sweepback used results in the aerodynamic centre of the wing being virtually coincident with the aircraft centre of gravity. Because of this, the difference between elevator angles for trim at high and low speeds with a fixed tailplane would be independent of the size of tailplane, and larger than that of unconventional aircraft with the aerodynamic centre forward of the centre of gravity.

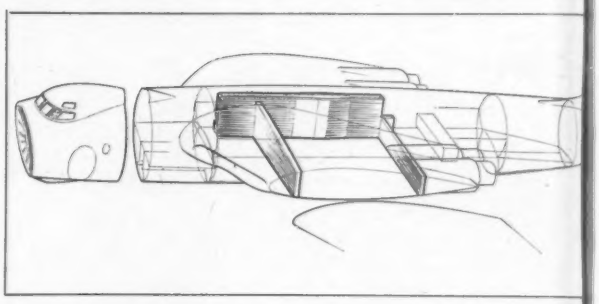
To get optimum performance the elevator angle for trim under cruising conditions must be small, and it was found impossible to satisfy this requirement with a fixed tailplane because there would be not enough elevator power for landing.

The area of the variable-incidence tailplane is considerably less than would otherwise have been the case because the aircraft is more stable due to the location of the aerodynamic centre near the centre of gravity.

Since the design of the Valiant was first laid out there has been no change in basic geometry except for the fitting of larger air intakes to suit more powerful engines. And the only change in function has been the adoption of flight refuelling as already mentioned. Underwing fuel tanks were part of the original scheme of things and give the required range without using an unnecessarily large airframe for internal fuel stowage.

Design of the Structure

The basis of the Valiant primary structure is a keel member or backbone in the top of the fuselage. This extends from forward of the front spar to the rear spar line. Bomb or other



store loads are hung from this keel, the fuselage taking only lift loads from the wings.

Starting at the front end of the fuselage, there is a nose fairing consisting of a metal upper section and a dielectric lower section. The radome lower section is fabricated from Hycar, glass cloth and Neoprene, bonded with Nuron resin to form a double sandwich.

Next is the pressure cabin for the crew, their controls and associated equipment. The stressed-skin structure of the walls is reinforced by closely spaced longitudinal stringers of lipped Z-section and bulb angle, supported on lipped channel-section open frames. The forward boundary of the cabin is formed by a concave bulkhead with radial stiffening beams. The rear boundary is an orthodox unstiffened convex shell.

Included in the pressure cabin are the faired jettisonable canopy, the roof-sextant dome and the visual bomb-aimer's compartment in the floor. In addition to the main entry door, on the port side, there are two elliptical windows, that on the starboard side is mounted in an emergency exit hatch for escape in the event of a crash landing.

Aft of the cabin is the main section of the fuselage containing the keel member, nosewheel bay, the servicing bay (popularly termed the " organ loft "), the rear bay for equipment, the bomb bay and the airflow deflector behind the bomb bay.

To avoid increasing drag by opening bomb-bay doors into the airstream, the doors travel up inside the bomb bay on rack-and-pinion mechanisms. There are eight of these on each side, three of which are driven by electric motors. Before this happens, however, the underside of the fuselage just aft of the bomb bay moves up inside the fuselage so that its forward edge is coincident with the roof line of the bomb bay. This moving section thus acts as a deflector for air entering the open bomb bay.

The entire fuselage, with the exception of the nose fairing, is of high-tensile light-alloy, stressed-skin construction with external flush riveting. It is of circular cross-section throughout except for the canopy and bomb-aimer's window. The main section of the fuselage has skin stiffened by closely spaced lipped Z-section longitudinal stringers and is supported by open frames. Only the stringers are attached to the skin, the frames being inside the stringers to which they are cleated. In the region of wing spars and fin there are heavily built-up frames.

The wing centre-section carrying the engines is of short span, the front and rear spars being built in halves integrally with the fuselage and joined at the fuselage centre-line by a fork-joint and taper bolts. Centre-section spars take the form of a fabricated light-alloy girder. Channel-section high-tensile booms

(*Continued on page 693*)

(*Continued from page* 692)

machined from the solid have webs riveted to the forward face with vertical stiffeners on the webs.

In the engine-bay region the spar sections around the air intakes and jet pipes are reinforced with thick machined light-alloy plates, joined by gussets.

The trailing edge of the centre-section is in two parts, the upper half being a fixed structure containing the jet pipe outlets and the hinged lower half forming the inboard flap.

Outer-plane spars are built up from heavy channel-section booms tapered-off to a lighter section towards the tips. Where the outer planes join the centre section the spar booms are locked together by fork-joints and taper bolts.

The stressed skin covering of the wing is stiffened by Z-section spanwise stringers and built-up ribs. The outward retracting units of the main undercarriage require large cut-outs in the wing underside, and the top skin panels over these wheel bays are reinforced by an inner skin. The wing-tank bays have light inner skins to support the flexible tanks.

Light-alloy preformed skin is used for the leading-edge structure of the outer planes, reinforced by plate diaphragm ribs attached to the skin by lipped Z-section lateral stringers. Ducts for the thermal de-icing air pass along inside the leading edge, supported by the nose ribs.

In the region of flaps and ailerons the trailing-edge fairing is a shroud with upper and lower skins riveted to rib diaphragms projecting from the rear spar. Built-up ribs carry the aileron hinges and actuating mechanisms. The flap-actuating mechanisms are mounted in fixed units in the wing trailing edge, picking up with fittings on the end ribs of each section of flap. Four dive brakes are hinged at their leading edges to brackets on the rear-spar bottom boom of each outer plane.

The fin is in two sections, that part below the tailplane and that above it with the dielectric tip. The two spars of angle-section boom-and-web construction carry the ribs, the spar booms of the lower part of the fin extending down into the fuselage where they are bolted to heavy spar frames. The rear spar carries the rudder hinges and shroud.

Ahead of the large variable-incidence part of the tailplane the small fixed portion is of triangular planform, an unswept spar forming the base of the triangle and carrying two hinges for the variable-incidence surface. This spar and the swept-back leading-edge members of the fixed tailplane are of angle booms and stiffened sheet webs. Ribs connect spar and leading edges and support the skin.

Built as a unit, the variable-incidence tailplane has leading- and trailing-edge members connected by diaphragm ribs. Spanwise channel-section members fan out from the centre-line to the tip on top and bottom surfaces for attachment of the skin. The trailing-edge member is built up of angle-section booms and a web. It is supported and operated by an irreversible two-start thread screw-jack, and carries the eight elevator hinges.

Valiants in Service

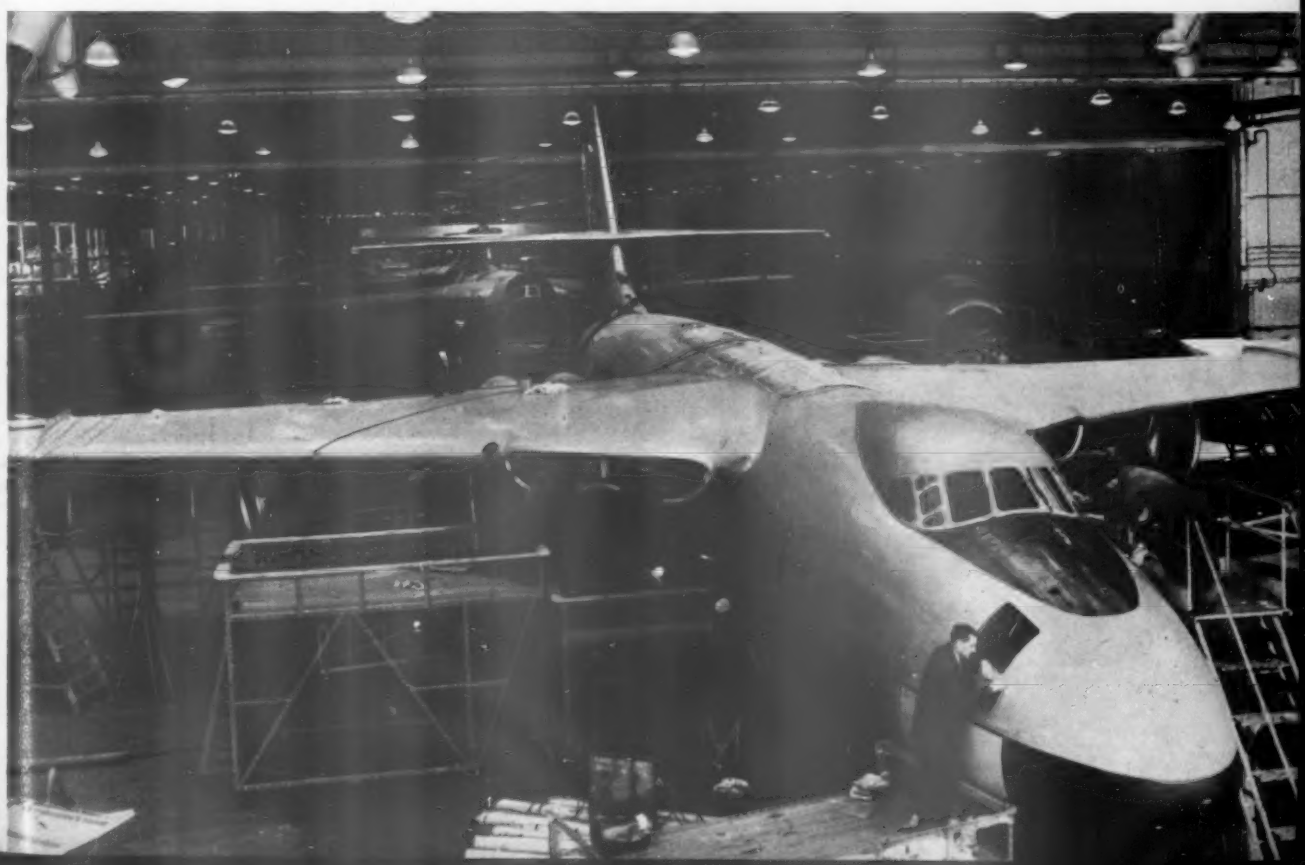
The Valiant is no longer being built, and the last production aircraft made its first flight on August 27, 1957. A hundred or so were built and the Royal Air Force has four types in service —the Valiant B. Mk. 1 bomber (Vickers Type 706); the B.PR. Mk. 1 bomber or photographic-reconnaissance type (Vickers Type 710); the B.K. Mk. 1 (Vickers Type 758) flight-refuelling receiver aircraft for bomber or tanker rôles; and the B.K.PR. Mk. 1 (Vickers Type 733), which is a receiver aircraft for bomber, photographic, reconnaissance or tanker rôles.

Eleven variants of the Valiant B. Mk. 1 basic type have been evolved for a variety of rôles. They include the B. Mk.2 low-level bomber with strengthened airframe to withstand the higher flight loads. Only one of this type was built, and it appeared at the 1954 S.B.A.C. Show. One obvious difference from all other Valiants was that the undercarriage was retracted backwards into nacelles projecting from the wing trailing edge. This allowed the erstwhile wheel-well cut-outs to be covered over and thereby considerably strengthen the wings.

The Valiant can carry a nuclear bomb and can also deliver the Avro stand-off bomb fitted with conventional or nuclear warhead. When the two later V-bombers are in full-scale service with the R.A.F. it would seem highly logical that the Valiant—which is very popular with its Service air crews—may be used mainly as a tanker aircraft for flight refuelling duties.

R.A.F. Squadrons operating Valiants are Nos. 7, 49, 90, 138, 148, 199, 207, 214 and 543. So far, No. 543 is the only squadron equipped with Valiant B.PR. Mk. 1 and B.K.PR. Mk. 1 aircraft. Eight R.A.F. Bomber Command squadrons form the total operational Valiant force; No. 199 Squadron uses the Valiant for special duties.

The story of the Valiant is one of success—an operational requirement which was met and exceeded by a versatile aeroplane which has proved its merit by being used for a variety of duties. A large number of companies have supplied materials and equipment for the Valiant production programme; a list of the names of many of those involved appears on page 700.—D.G.



THE FIGHTING SERVICES

South American Tour

AS recorded in previous issues of THE AEROPLANE, an R.A.F. mission headed by the Secretary of State for Air, the Rt. Hon. George Ward, attended the Argentine Presidential Inauguration ceremonies in Buenos Aires on April 25. The detachment, commanded by Air Vice-Marshal G. A. Walker, A.O.C., No. 1 Group, Bomber Command, and consisting of two Vulcans of No. 83 Squadron, supported by a No. 216 Squadron Comet and two Hastings of No. 24 (Commonwealth) Squadron, returned to the United Kingdom last week after a successful tour of South America.

On the outward flight the Comet (XL670)—the first in Transport Command to have a polished underside—commanded by Sqn. Ldr. G. C. McCarthy, M.V.O., A.F.C., covered the 7,214 miles to Buenos Aires via Gibraltar, Dakar, Recife and Rio de Janeiro, in an overall flying time of 16 hr. 50 min. An average speed of 477 m.p.h., and 5 hr. 50 min. better than the schedule.

The Vulcan flight time for the journey, made by way of Dakar and Rio de Janeiro only was 13 hr. 12 min. giving an average speed of 544 m.p.h. for the total distance of 7,003 miles. The leg from R.A.F. Waddington to Dakar was covered at an average speed of 498 m.p.h. and the two following legs at an average of 540 m.p.h. and 594 m.p.h. respectively.

R.A.F. Regatta

APPROXIMATELY 130 oarsmen will represent R.A.F. rowing clubs in the United Kingdom at the 1958 R.A.F. Rowing Regatta on the Ouse at Bedford on May 31. This is the first time that Bedford has been chosen since the new policy of changing the regatta's meeting place each year was introduced, although R.A.F. crews have rowed there in local regattas.

At present there are 25 R.A.F. rowing clubs and the principal award will be the Scott-Paine Trophy for the unit whose crews put up the best overall performance. Events will include an invitation race for non-Service crews and the Veterans Sculls.

Manchester U.A.S. Dinner

IN proposing the toast to the Manchester University Air Squadron at its annual dinner in the University on May 2, AIR MARSHAL SIR DOUGLAS MACFADYEN, K.C.B., C.B.E., A.O.C.-in-C., Home Command, said that more rubbish had been spoken about the future of the R.A.F. than about anything else. "The I.C.B.M. is part of air power but it is not necessarily a substitute for man-power. I think the manned bomber under the immediate control of the human brain will always have a future in our strategy."

He congratulated the Squadron on winning the de Havilland Trophy for the second year in succession, and on completing more flying hours than any of the other University Air Squadrons. The A.O.C.-in-C. added that the unit had a remarkable record in over 2½ years free of avoidable accidents.

Replying to the toast to the University, proposed by AIR VICE-MARSHAL H. V. SATTERLY, C.B., C.B.E., D.F.C., A.O.C. No. 64 (Northern) Group, PROFESSOR W. M. COOPER, the Vice-Chancellor, said that the University was rich in experience and richer in personality. Many developments in this nuclear age had begun in the University laboratories and three Nobel Prize winners had been produced.

The Cheshire Trophy for the best all-round cadet of the year was presented to Plt. Off. D. Simons, and the Campbell Trophy for aerobatics to Plt. Off. J. Larcombe.

SQUADRON RECORD.—No. 114 Squadron has been disbanded and a photograph showing its wartime record is available to former members. Copies, price 3s. each, can be obtained from Sqn. Ldr. D. Nixon, Northcote, Gloucester Road, Stonehouse, Glos.

A Bomber Tie

A TIE has been designed for wear exclusively by officers and airmen who have served or are serving with No. 1 Group, Bomber Command. The design consists of Panthers' Heads (the No. 1 Group Crest) in silver upon a Lincoln Green background. Ties, which cost 22s. 6d. in silk, and 15s. 6d. in rayon, may now be obtained from Gieves, Ltd., 27 Old Bond Street, London, W.1.

CHAIN OF COMMAND.—On April 24 the Standard was presented to No. 33 Squadron at R.A.F. Leeming. Former Squadron Commanders at the ceremony were, left to right, Air Chief Marshal Sir Philip Joubert de la Ferté, who made the presentation, A.V.M. F. P. Don, Wg. Cdr. W. H. De W. Waller, Air Marshal Sir Hugh Walmesley, Air Chief Marshal Sir John Baker, Gp. Capt. J. Bradbury, Gp. Capt. J. H. McC. Reynolds, Wg. Cdr. R. R. Mitchell, Wg. Cdr. R. N. G. Allen, Wg. Cdr. A. K. Furse, Wg. Cdr. C. C. F. Cooper, Sqn. Ldr. N. P. W. Hancock, Wg. Cdr. R. C. Patrick, and the present C.O., Wg. Cdr. N. Poole.

PRIVATE FLYING

H.J.C.'s Club Commentary:

● YET ANOTHER old type of aeroplane which, we hear, is to re-emerge is the Currie Wot, an ultra-light single-seat biplane which first appeared at Lympne in 1938. It then had a 36-h.p. J.A.P. engine, and is now being built by the Hampshire Aeroplane Club at Eastleigh, Southampton, where the chief engineer is Mr. John R. Currie, who originally designed it for Cinque Ports Aviation, Ltd.

The club hopes to have it flying shortly, under a permit to fly, and if it is successful another five more are to be produced. It is an all-wood aircraft and it should sell at about £500.

The original aircraft (two of which, G-AFCG and G-AFDS, were built) cruised at 65-72 m.p.h. and landed at 37 m.p.h. Fuel consumption was 2.5 g.p.h. The wing span was 22 ft. 1 in., the length 18 ft. 2 in. The Wot (and perhaps someone will tell us why it is called the Wot) weighed 575 lb. loaded.

REVIVAL.—The 1938 Currie Wot single-seater, which is being rebuilt by the Hampshire Aeroplane Club.

● IT MAY be remembered that in 1953 the R.Ae.C. organized a competition for the design of a light touring aircraft, and that the first prize, of £100, went to three Australians, H. K. Millicer, G. D. Bennett and J. M. Tutty.

We now hear, from Mr. L. H. Yardley, that the Aero Club Federation of Australia has granted a £1,000 subsidy for the development of this type. The annual conference decided to provide financial support for the aircraft because member clubs were "so impressed with its possibilities for training purposes." For two years a private construction group within the Ultra Light Aircraft Association has been making slow progress in the face of shortage of funds. With the help of the subsidy it is planned to make preliminary flight trials within six months with a view to getting a C. of A. in nine months and the aircraft evaluated for aero club work before next year's meeting of the A.C.F.A.

The report of the judges of the competition contained the following with regard to this design: "While commending the designer for the simplicity of the design afforded by the wooden construction, it is considered that the appeal of the type to the universal operator would possibly be affected by the demand for metal construction."

It will be interesting to see whether or not a wooden aircraft can prove to be adaptable for series construction when the present trend is for metal aircraft.

● THE AIR TOURER is a two-seat low-wing monoplane with a nose-wheel undercarriage and side-by-side seating. It was originally designed to have a 75-h.p. Cirrus Minor engine but has been modified to take either the 65-h.p. Walter Mikron or the Continental A65. It is an all-wood design, will be semi-aerobatic, and should operate at about half the cost of a Tiger Moth. The estimated performance is: maximum level-flight speed, 120 m.p.h.; cruising speed, 105 m.p.h.; maximum rate of climb, 600 ft./min.; maximum range, with 25-gal. tank, 800 miles.

● POLISH BORN chief designer, Mr. Henry Millicer, is chief aerodynamicist at the Government Aircraft Factories, Melbourne. He flew with the Polish squadrons of R.A.F. Bomber Command during the War and later worked as senior aerodynamicist for Airspeed and as assistant chief aerodynamicist for Percival.

Incidentally the first ultra-light aircraft to fly in Australia was a Stits Flut-R-Bug, an American design, which was assembled at Moorabbin, Victoria, recently.

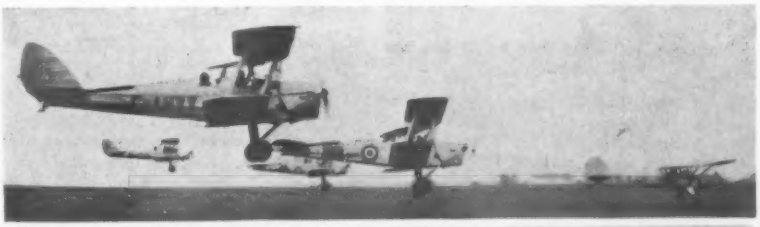
● FIRST NEWS for some time from the **Blackpool and Fylde Aero Club,** which flies from Squire's Gate aerodrome, tells of more than 100 hours' flying in April. Among new P.P.L. holders are J. Smith and M. Parker, and first solos have been flown by C. Mullard and W. Towse.

The club fleet consists of two Autocrats, G-AIGD and G-AJUL, an Auster J.4, G-AIJR, and a Chipmunk.

● IT APPEARS that part of the information published in our April 25 issue about the **Bristol and Wessex Aeroplane Club** at Lulsgate was incorrect, and we extend apologies for stating that it was in danger of closing some months ago.

Mr. L. R. Williams writes:—

"I have been the honorary secretary of this club for 28 years out of its 31 years' existence and it is news to me that we had any troubles that were so serious that we may have had to close down. I would say that we are one of the most conservative and prosperous clubs in the country; we have always been in this category and are one of the few original clubs left who operate as a private club, non-profit making and non-commercial. Throughout the history of the club there has at no period been any question of a suspension of activities and, in fact, from a flying point of view, the club has gone from strength to strength and now has probably more flying members than any club in the country with the odd exception. To augment these flying members there is a very active social membership as instanced by a recent dance in the terminal building at Bristol's new airport, where 500 guests were present."



PLYMOUTH PARTY.—At Roborough aerodrome at Easter there was some formation flying with the Plymouth Aero Club's Autocrat and two Tigers, plus two Royal Navy Tigers used by the Dartmouth cadets. The lower picture shows, left to right, Philip Cleife (C.F.I.); W. H. W. Lucas (manager); Bill Boylett, Sue Burges (British Parachute Club), Peter Lucas, and Peter Lang and Flg. Off. Ken O'Rourke (B.P.C.).

CORRESPONDENCE

Cody De-Cody-fied

RECENTLY a report (in two parts) has been circulated to the Press under the title *The First Powered Aeroplane Flight in Great Britain*, by Mr. Charles Gibbs-Smith. It sums up the evidence against the accuracy of the wording on a plaque on the airfield at Farnborough; the wording is as follows:—

> Col. S. F. Cody picketed his aeroplane to this tree and from this spot on 16th May, 1908, made the first successful officially recorded flight in Great Britain.

"After certain doubts about this statement had arisen two investigations were undertaken," writes Mr. Gibbs-Smith. "One by the Royal Aircraft Establishment and one by the present writer. . . . Both the Royal Aircraft Establishment and myself have now come to the conclusion that the date May 16 was arrived at in error and that it must be abandoned. But both also agree that Cody was still, indeed, the first to make a powered and sustained flight in Britain, but that the date was October 16, 1908; this date is now officially accepted by the Royal Aircraft Establishment."

Mr. Gibbs-Smith quotes Colonel J. E. Capper's report to the War Office of Cody's flight of October 16, 1908. Capper at the time was Superintendent of the Balloon Factory, and witnessed the flight.

"He was, I should estimate," reported Capper, "at a height of 16-20 ft. above the ground at the time. . . . The total distance of flight, as far as can be measured by a corresponding path of travel, was 1,390 ft."

Mr. Gibbs-Smith notes: "When Mr. Broomfield (who put forward the date May 16 in his biography of Cody-J.L.P.) comes to this flight, he quotes Cody's account to the Aeronautical Society but incorrectly dates the flight as October 5th (see page 58 of his book)."

He has, I think, been unfair to Mr. Broomfield by not giving his actual words and by implying that the information came from Cody in his lecture to the Aeronautical Society. Cody did not give any figures about the distance flown or the height of the flight in question to which Mr. Gibbs-Smith and the Royal Aircraft Establishment refer. Mr. Broomfield did, however, and these are his words:—

"After many other experimental 'hops' Cody, on 5th October, 1908, made a flight of 496 yards at a height of 50 to 60 ft., which was terminated by a serious accident that nearly proved fatal."

Note the distance and the height, which do not agree with Colonel Capper's report to the War Office. It is interesting to inquire how Mr. Broomfield came to publish these figures which are at such variance with those now published by the R.A.E. and Mr. Gibbs-Smith.

Mr. Broomfield's book was published in 1953 and reviewed in THE AEROPLANE on March 3, 1954, by W. O. Manning, himself one of the early pioneers and a great admirer of Cody. He commented on certain technical errors in the book, but questioned no flying dates.

Six years before Broomfield's biography of Cody was published, an official report (No. Aero 2150, March, 1947) was circulated by the Royal Aircraft Establishment. The report was entitled "A Historical Summary of the Royal Aircraft Factory and its Antecedents, 1878-1918."

It was from this report that the date October 5 came, and the details of the flight. One of the recipients of the report was Cody's son, Vivian Cody, who wrote an introduction to the author in Broomfield's book.

The report contains two rather remarkable references to the date and details. The first is an entry as follows:—

> "1908, Oct. 5th. First official aeroplane flight of 496 yards at a height of 50-60 feet in Great Britain performed at Farnborough by S. F. Cody."

The other is an air photograph of that part of Farnborough where Cody flew. On the photograph has been boldly drawn the path of Cody's flight, the wind direction, trees, where Cody crashed, where he took off and where he became airborne, and a scale of distance. The photograph is labelled, in a special box, "First official Aeroplane Flight in Great Britain. Length 496 yards, height 50-60 ft. Performed at Farnborough, Hants, by S. F. Cody, 5th October, 1908."

The diagrammatic-photograph measures 11 in. by 6½ in., so could hardly be overlooked!

The Foreword to this official report says: "The draft of this Report has been read and approved by . . . (here is a long list of well-known names in aviation) . . . . The comments and corrections which have been kindly supplied have been incorporated as far as possible in the final text."

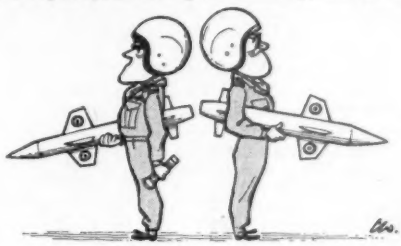
And which is the first name in the long list of those who "read and approved"?

Why, no less than that of Colonel J. E. Capper (in 1947

(*Continued on page* 697)

Groundabout

The New Few. In Fighter Command, a stern battle is afoot. Who's to have the P.1? The day fighters say "It's a single-seater—it's for us." The two-seat fighters say "It's all-weather—it's ours." Better have single-seaters *and* two-seaters, lots and lots of 'em, then everybody, including the Industry, will be happy.



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The Flying Years. I'm glad to report that after reading this column's appeal for a First-War flying kit for the pilot of R.A.E. Farnborough's rebuilt S.E.5a, Mr. Ronald Sykes, ex-R.N.A.S. pilot, generously offered his own precious relics. They are, he says, "somewhat oil-stained and soggy-looking, but perhaps that will not matter because some of the R.F.C. aeroplanes were in that condition in 1917-18." A friendly letter but almost spoiled for me. It started "Dear Sir (or Madam) . . . ."

*

"Nice speech of Frank's."

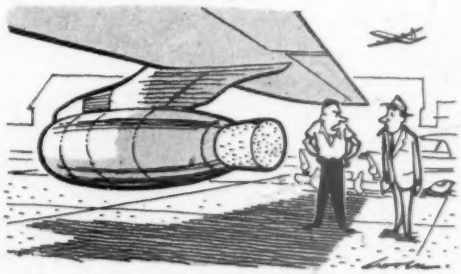
"Well, I thought it wasn't so much a speech as six limericks."

*

Status Quotes. In one of the British newspapers I missed while abroad, there was news worth passing on to you columnees (people who are columned at). Mr. Duncan Sandys, says the report, is an amateur magician who specializes in sawing people in half. I feel a Wrhyme coming on:—

The dext'rous handys of Duncan Sandys
Can saw a gal in twain,
But oh! how strange when for a change
He joins her up again.

*



"O.K. Joe, now tell these airport noise people to come on over and bring their dam' decibels along . . . ."

by Gren

(*Continued from page* 696)

Major-General Sir J. E. Capper), who witnessed the flight of October 5 (as given in the report).

And who also read and approved the draft? Why, Vivian Cody, the great man's son.

Farnborough repeated the distance and height in their Souvenir Programme of 1955, but left the date vague. The distance was also given in Part II of the Aeronautics (Heavier-than-Air) Catalogue of Exhibits of the Science Museum (published May, 1949): "Cody made a flight of 75 yards in September, 1908, and 496 yards in October the same year," to quote the exact words, which any member of the public could read for 3s. It might also be noted that in THE AEROPLANE for May 30, 1952, there appeared a letter from Mr. Broomfield giving the date October 5 and distance 496 yards, but I do not remember it was commented upon.

I am not trying to put a case for any date or even year. But I wanted to say that Farnborough have now *officially* (their word) accepted May 16, October 5 and October 16, 1908. The first date has now been "de-officialized" by the Director of the Royal Aircraft Establishment in a circular to the Press. What about the second? And when will the third be? Mr. Gibbs-Smith has thrown over May 16, has said Mr. Broomfield incorrectly dates the October 16th flight as the 5th, and adds: "This famous flight, with its effort to avoid the clump of trees and the subsequent serious crash, is fully documented textually and photographically as being on October 16th."

I know how easy it is to make mistakes when writing history. I have made too many. I may be barking up the wrong Cody tree, but I would like to know why the Royal Aircraft Establishment and Mr. Gibbs-Smith have been so strangely silent about a date and a distance which have appeared in official documents for the past nine to 10 years.

Preston Park, Sussex. J. LAURENCE PRITCHARD.

Another Airworthy Moth

PURELY as a matter of interest I would like to refer to a number of THE AEROPLANE published a few months back [December 20, 1957] in which an American reader gave details of his aircraft, a D.H.60 Gipsy Moth. He was interested to know of other "Gypsys."

A grazier friend of mine, Mr. Reg Betts, of Balgi Hebel, Queensland, owns one, a metal job which was built at Edgware in 1929.

He uses it for mustering sheep, driving the sheep up into a corner, nips back home, hops into a tractor and with his dogs finally drives them into the yards.

He also lands in front of my store, collects his goods and mail and beetles off home.

The Gipsy I motor is no trouble, it motors him up and down

The Cessna 182 referred to by Mr. Cannon is typical of the competition which Britain has to meet abroad.

fences for inspection, looking for the stray cattle and sheep.

Reg will be disposing of VH-ULM very shortly as his Cessna 182 is due to be collected in a fortnight's time.

I am a member of the Royal Aero Club of New South Wales, Bankstown, and the club totalled 1,157.30 hr. last month. It was the club's monthly record.

Queensland, Australia. G. W. CANNON.

GLIDING NOTES

A PRELIMINARY list of entries in this year's World Championships has been sent out by the Polish organization which is running them. Nine countries, out of the 29 intending to come, are reported to have sent in their entries officially, and it appears that twice as many pilots are going to fly in the open class as in the standard class, which has a 15-m. span limit.

Each of these countries has entered in both classes, with three exceptions, all from the British Commonwealth, whose pilots are determined to fly the best machines they can borrow, regardless of span, and have all entered in the open class. They are: Harold Burditt, from Rhodesia, and Evert Domisse, from South Africa, each of whom is being lent a Polish Jaskolka; and three Canadians, W. J. Mix, Charles Yates and Gordon Oates, who are uncertain yet whether they will borrow Breguet 901s from France or Jaskolkas from Poland.

The Austrians, Yugoslavs and Hungarians are bringing machines designed in their own countries; the Swedes all have Zugvogels from Germany, and the Danish entries include two EoN Olympias for the standard class. From the United States come Stanley Smith and Paul Bikle, each borrowing a Breguet 901; Lyle Maxey, flying a Jaskolka; and Francis Compton, entered in the standard class with a Polish Mucha-100.

* * *

Actually, a specially modified Mucha (which means "fly") has been produced in Poland for the standard class, and was recently test-flown by Adam Zientek. The ordinary Mucha is in wide use in Poland and is being built under licence in China, while some are flying in Switzerland, France and East Germany. The "standard class" version has an aspect ratio of 17.6 and a wing loading of 5.14 lb./sq. ft.; but Mr. Zientek does not give details of how its performance has been improved.

* * *

The French team is announced in *Aviasport* for May; Mm. Barbera, Labar and Weiss are flying single-seaters and Mm. Fonteilles and Marchand a two-seater Breguet 904. M. Landi is team captain. Barbera, who made a remarkable flight last February from St. Auban, in France, to Ellikon, in Switzerland, will fly a Breguet 901, but it is uncertain whether the others will use the Fauvel AV-22 two-seat flying wing or if the new Breguet 905, designed for the standard class, will be ready in time.

The Breguet 905, which had its first flight last month, appears to carry on the traditions of its numerical predecessors. The wing is "semi-laminar," and has a straight taper, with streamlined "shapes" at the tips—and, by the way, nobody has yet followed Dr. August Raspet's advice, given as long ago as 1950, that these shapes should be 2½ times as long as the tip chord and 2½ times as wide as the tip thickness. There is the usual V-tail. The calculated gliding angle is 1 in 32 at 72 k.p.h. (45 m.p.h.), and minimum sink 0.6 m./sec. (23.6 inches/sec.) at 60 k.p.h. (37 m.p.h.). It sinks at 1.10 m./sec. at 100 k.p.h. (62 m.p.h.) and 5 m./sec. at 150 k.p.h. (93 m.p.h.).

It would be interesting to see one of M. Fauvel's flying wings in a World Championship meeting. He has just brought out an improved version of the single-seater, called AV-36 Mk. II, which has a best gliding angle of 1 in 26 (equal to that of the two-seat AV-22) and a minimum sink of 0.74 m./sec. (29 in./sec.), which is 2 in./sec. better than before. M. Fauvel writes that his Coupe Survol, which he awards annually for the best flight on one of his machines, went for 1957 to Michel Mougel, aged 20, who flew 502 km. from Nancy to Poitiers from his fourth launch in an AV-36; it took him 6 hr.

The German pilots at the World Championships will be Heinz Huth, Jakob Laur, Ernst-Günther Haase and Dr. Frowein. The Japanese team has applied for the loan of the very latest and most refined Polish design, the Zefir, "without regard to cost"; but it will not be ready in time and they will have to put up with a mere Jaskolka.

Two Belgian pilots will each fly a German Ka-6 in the standard class, Mr. van Ishoven writes. They are P. Lafosse, who has a Gold C and two Diamonds, and A. Xhaet, a Silver C pilot. This strange name seems to have got on the minds of the writers of the Polish bulletin, for they have referred to the Canadian pilot, Charlie Yates, as Mr. Xeates.

The period of the OSTIV Congress at Leszno, which was to have begun during the practice period of the Championships, has been changed to June 19-28. Delegates are to be housed in a fine old castle adjoining a lake at Osieczna, nine miles from Leszno airfield.

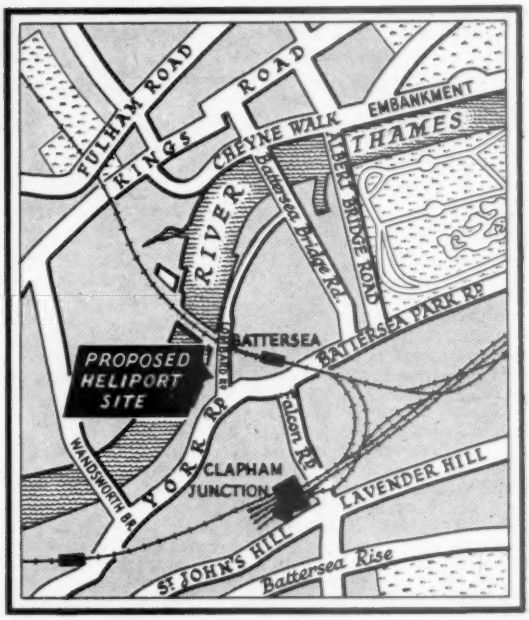
* * *

IN describing in these Notes the flights on April 27 of three Lasham pilots from Nympsfield, one of whom, Lorne Welch, flew 188 miles on a crooked course to Lympne, I presumed they were not in temporary residence but had been towed there. So they had, but by road. Brenda Horsfield writes that the three machines were loaded into trailers at 05.30 hrs. and reached Nympsfield in time to be launched at 11.00 hrs. Lorne Welch took from 11.15 to 16.30 over his subsequent flight.—A. E. SLATER.

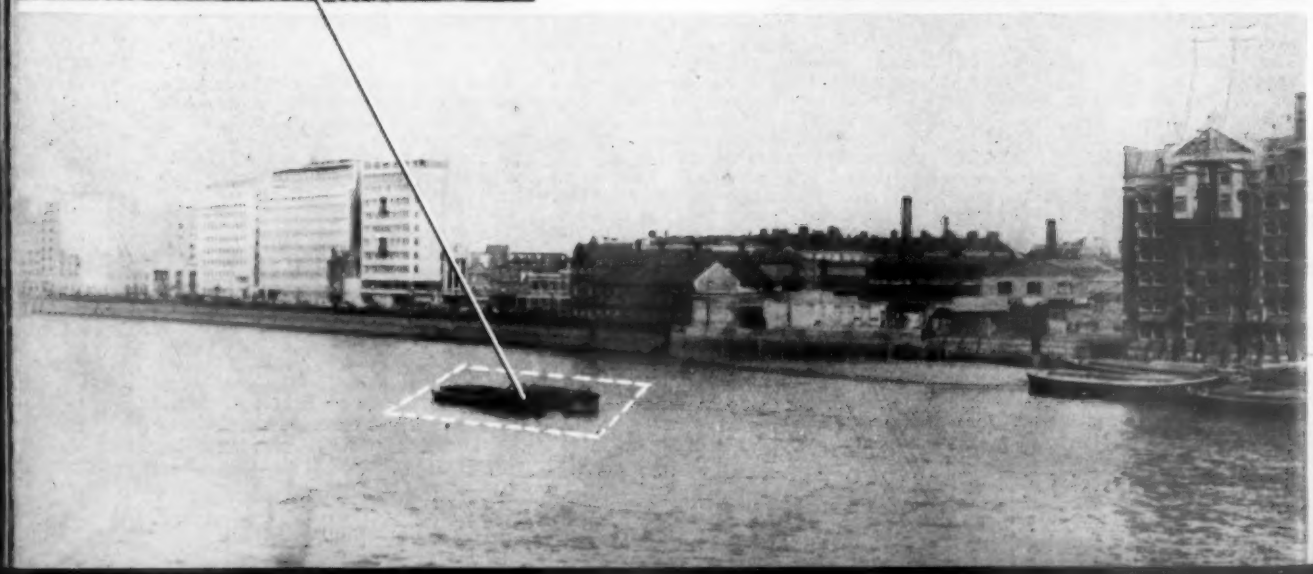
Heliports for London

Photograph copyright "The Aeroplane"

Schemes for helicopter operating sites on or alongside the Thames have been put forward by Rotorports Ltd. and Westland Aircraft Ltd. respectively. On this page we illustrate the two schemes—above, is the site selected for the Thames-side Westland heliport near Battersea of which an artist's impression is shown left and location-map below.



Left, the Rotorports proposal is a floating platform moored on the river opposite the Tate Gallery; the photograph below shows this site. A launch will be used for transport to and from the shore.



Pathfinders and Bomber Progress

SPEAKING at the annual dinner of the Pathfinder Association at the Dorchester on May 7, the Vice-Chief of the Air Staff, Air Marshal Sir Edmund C. Hudleston, told his audience of wartime bomber personnel that aircrew standards of today were better than ever before. The young personnel now flying in the R.A.F. "were quite fantastic," and had an efficiency unknown 10 or 12 years ago.

The V.C.A.S. said that it used to be Fighter Command that was thought of in terms of readiness, but the same techniques were now being applied to the bomber force. "We don't follow exactly the same pattern of S.A.C.," he added, "but we can get off the ground in an extraordinarily short time." He quoted the example of a recent exercise on a V-bomber station, in which crews were airborne in 11 min. from an alert, in the middle of the night.

That was the aim, but it became an expensive business when the time was cut to less than 15 min. Overheads then went up a very great deal, so that for conventional aircraft 15 min. was sufficient, as we get more than that in warning time. With missiles, however, this might be reduced to 4-5 min.

Service thinking had changed in the past few years, and we were beginning to learn more about missiles. These still had an awful lot of bugs in them, and although they were essential and effective, it would be a mistake to rely on them completely. The firm conclusion had been reached that an element of manned aircraft must be retained in offensive and defensive forces. Missiles were sophisticated and predictable, but complete predictability was not required, and the human element was needed for defeating defences.

President of the Pathfinder dinner was Air Cdre. Michael Birkin, and the guests included present members of the Air Council and Bomber Command, while among the retired bomber personalities were Air Marshal Sir Robert Saundby and Air Vice-Marshal D. C. T. Bennett. For the first time since the War Dr. J. C. McGown was unable to be present on this annual and always enjoyable occasion.—J.E.F.

Air Commodore Sir Vernon Brown reviews:—

Danger in the Air*

THIS is a stimulating and interesting book which I can strongly recommend to anyone interested in flying.

There are two good reasons why accidents should be investigated: the first, that until the cause is known no remedial action is possible; and the second, for the advancement of aeronautical science and the improvement of flying technique.

The author has set out to show how a careful study of accident reports can achieve these ends, and he has succeeded admirably. Each chapter deals with a particular danger and is illustrated by one or more chosen examples.

Unfortunately, he has detracted from the sheer pleasure of the reading by the constant buzzing of two bees under his bonnet. For a long time Major Stewart has urged the use of the metric system and there are, of course, many who agree with him that the way we muddle along today using two systems is often very disconcerting. Nevertheless, so long as we in the U.K. speak of visibility in yards and miles and of cloud height in feet I can see no justification for using the metric system and putting our own figures in brackets; indeed, I found it very irritating.

Before reaching the end of the book his other bee had become a veritable hornet—I refer to his remarks about "pilot error." He has referred to this over and over again, but here are just two examples. On page 148 he protests:—

"In fact I go so far as to say that, when no other cause can be clearly seen, those who investigate air accidents are too prone to attribute the fault to the pilot."

And again, on page 159:—

"The accident investigators must try to form an opinion on the cause of an accident and it is not suggested that they are biased against the pilot. But it has become customary, almost traditional, to find pilot error as the cause of an accident involving asymmetric flying which, on closer investigation, might equally well, perhaps better, be placed at the door of those who designed and built . . . ."

That seems to me very strange reasoning and, with respect, I say emphatically that it simply isn't true.

His chapter about the Comet accidents is admirable and all the more forceful for the simplicity of the telling.

In his story of the loss of the "Star Ariel" I was surprised he made no reference at all to the rather similar and unexplained disappearance of "Star Tiger." Incidentally, it may be of interest that during the "Star Ariel" investigation I learnt that between 1900 and the end of 1948 (omitting the War years) more than 50 ships, varying in size between 4 tons and 8,600 tons, were lost in the North Atlantic without trace.

In respect of Derry's accident at Farnborough, the Official Secrets Act forbids me to say more than that the author's theory is not the accepted one.

Finally, I would like to add that it wouldn't surprise me at all if, one day, the sequel to that remarkable tale of Criminal Intent were told.

I am a great believer in accident publicity of the right kind, and this certainly is of the right kind. It holds one's interest and I found it difficult to put the book down until I'd finished it. Accidents are sometimes unpleasant subjects for discussion and the author has never allowed himself to be gruesome or macabre; but as to whether the reporting of air accidents in newspapers in the most harrowing way possible is a good thing, I am afraid Major Stewart's views and mine are not the same.

* "Danger in the Air." By Oliver Stewart. 194 pp., 5¾ in. by 8¾ in. Illustrated. Routledge and Kegan Paul, Ltd. Price 28s.

Fleet Air Arm Future

FUTURE PLANS for Naval aviation were disclosed on May 5 by Capt. O. N. Bailey, O.B.E., Deputy Director of Air Warfare at the Admiralty, in a lecture to the Graduates' and Students' Section of the Royal Aeronautical Society. His talk was entitled "Future Trends in Naval Air Warfare."

Capt. Bailey opened by outlining the Navy's rôle in peacetime and during limited and global conflicts. In times of peace its duties were policing, showing the flag and training. In limited wars it was responsible for protecting supply routes and for providing seaborne and air support for ground forces. Its rôle during a global war was at present given the lowest priority, as it was assumed that allied nations would provide the bulk of the Naval power. But aircraft carriers would play a major rôle in nuclear retaliation if Britain were attacked.

Today the Fleet Air Arm was the main weapon of the fleet, said Capt. Bailey. Unfortunately financial stringency limited the number of carriers and aircraft available to the Navy. There were to be only three carriers operational at any given time with a fourth, the "Bulwark," available as a commando carrier, equipped with helicopters, for rushing troops to trouble spots. Of the three main carriers, two were to be based west of Suez and one to the east. At present these carriers were the "Victorious," which would be fully operational at the end of this year, the "Ark Royal" and the "Eagle."

The "Victorious" was the most up-to-date British carrier. Its Scimitar squadron, which had nuclear capability, would embark in September. This carrier had the best seaborne radar in the World; enemy aircraft could be detected at ranges not before achieved and intercepted before they could be a danger to the Fleet. Other features of the "Victorious" were its angled flight-deck, steam catapult and mirror landing sight.

Capt. Bailey went on to survey the aircraft of the Fleet Air Arm and the rôles they would play. Speaking of anti-submarine warfare, he said that effort was now being concentrated on helicopters; Fairey Gannets would no longer be used. Nuclear submarines had no need to surface and thus could not be detected by airborne radar. Submarine detection was now by equipment which was suspended in the water by helicopters. Current helicopters were able to carry only the sonar gear but the Wessex would carry homing weapons also.

Another problem posed by the nuclear submarine was its speed. During exercises the American "Nautilus" had cruised submerged in company with aircraft carriers on the surface; underwater speeds of up to 60 knots were foreseen. Surface vessels could not cope unaided with such submarines.

Future protection of the Fleet would depend on Sea Vixens and Scimitars acting as fighters.

In the strike rôle there were the Scimitar and the N.A.39 for which, Capt. Bailey hoped, orders would be placed soon. Both these aircraft could carry nuclear weapons and the N.A.39 could, if necessary, make long-range strikes flying the entire mission virtually at surface level.

Questioned about the difficulties of flying the N.A.39 at high speed at zero level, Capt. Bailey expressed his confidence that this could be done, but added, "When I say zero the aircraft will probably be at about 50 ft."

NOTES AND EVENTS

TWENTY-FIVE YEARS.—Two special postage stamps, one of which is reproduced here, were issued on April 30 to commemorate the silver jubilee of the Indian Air Force. The aircraft shown are a Westland Wapiti of 1933 and a present-day Hawker Hunter.

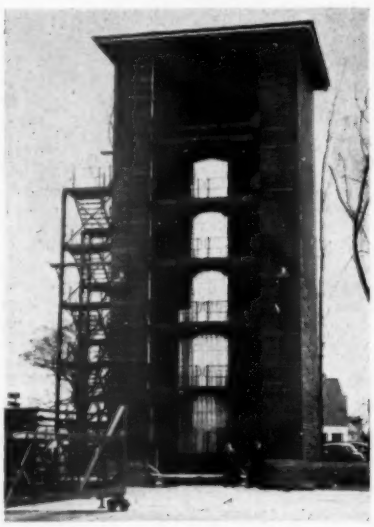
GOODYEAR DEVELOPMENT.—A pressure-metering valve to provide a means of controlling the pressure supply to hydraulic equipment has been developed by the aviation products division of the Goodyear Tyre and Rubber Co. (G.B.), Ltd., at Wolverhampton. It has been developed for industrial use from the unit employed in Viscount brake-control relay valves.

FOKKER FILTER.—We learn from Tecalemit, Ltd., that they supplied fuel filters for the water-methanol system used for the Dart powerplants in the Fokker Friendship feeder-liner described in detail in our issue for April 11. Their name was inadvertently omitted from the list of suppliers accompanying the article.

VENNER RANGE.—A new range of silver-zinc accumulators completely sealed in resin has been produced by Venner Accumulators, Ltd., of New Malden, Surrey. Introduced to meet the requirements of the electronics field, the accumulators (HT125) consist of a number of individual cells which have a nominal capacity of .125 amp. hr.

SURVIVAL EQUIPMENT.—A non-inflating plastic life jacket, fitted with air vents covered with an air "breathing" material which is self-sealing when it comes in contact with water, has been developed by Marksway Wear, Ltd., of London. Consisting of a number of "envelopes" which become airtight when wet, the life jacket has no mechanical components and is extremely light in weight.

AIRCRAFT TYRES.—The Firestone Tyre and Rubber Co., Ltd., has published a new data book giving technical details of many of the aircraft tyres in the company's range. The book is available, in limited numbers, from the Aviation Division, Firestone Tyre and Rubber Co., Ltd., Brentford, Middx.



IRBM TEST RIG.—Now in place in this large rig at Hatfield is a test section of the de Havilland IRBM, which is about 70 ft. long and 10 ft. in diameter.

Company Notices

NEW COMPANY

Goodhew Aviation (Transport), Ltd. (603,611).—Private co. Reg. April 28. Cap. £100 in £1 shs. Directors: Leslie J. Brockhouse, 94 Richmond Rd., Wolverhampton; Peter S. Clifford, Tresa, Kirtlington, nr. Oxford; and Charles F. Cockburn, The Cottage, College Farm, Ferry House, North Hinksey, Oxford, all directors of Goodhew Aviation Co., Ltd. Sec.: Nora E. H. Spring. Reg. off.: Oxford Airport, Kidlington.

INCREASE OF CAPITAL

Cramic Aircraft Components, Ltd. (595,658), Bridge Rd., Southall, Middx.—Increased by £124,900 in £1 ordinary shs., beyond reg. cap. of £100.

New Patents

APPLICATIONS ACCEPTED

797,019.—Mignot, G. L. G. M.—"Aircraft."—Nov. 18, 1955. (Nov. 30, 1954.)

797,105.—Electro-Hydraulics, Ltd.—"Retractable landing gear for aircraft."—Oct. 17, 1956. (Nov. 29, 1955.)

Applications open to public inspection on June 25, 1958; opposition period expires on September 25, 1958.

Aviation Calendar

May 17-19.—Fourth International Air Touring *rassemblement* at **Quiberon-Le-Roche,** France.

May 18.—Air Rally organized by the Perugia Aero Club, **Italy.**

May 21.—Kronfeld Club debate, "The Golden Age of Gliding has now Passed," at 74 Eccleston Square, **London,** S.W.1, at 20.00 hrs.

May 24.—Cheltenham Aero Club Tea Patrol at **Staverton,** Glos. (15.30-16.00 hrs.)

May 24-26.—R.Ae.C. of Belgium *bienvenue aérienne* at **Brussels.**

May 25 - June 1.—Second International d'Angers gliding competition organized by l'Aéro Club de l'Ouest, **France.**

May 26.—R.A.F.A. (Eastern Area) Air Display at **Hucknall Aerodrome,** Nottingham.

May 26.—Race Meeting organized by the Tiger Club at **Sandown Airport,** Isle of Wight, for the Basil Monk Trophy.

May 28.—Kronfeld Club talk, "The Cambridge University Gliding Club," by John Pringle, at 74 Eccleston Square, **London,** S.W.1, at 20.00 hrs.

May 29-31.—R.Ae.C. International Invitation Air Rally at **Shoreham Aerodrome,** Sussex.

May 31 - June 1.—British Women Pilots' Association, Flying Week-end, at **Sandown Airport,** Isle of Wight.

June 1.—*Rallie Bonneterie*, organized by l'Aéro-Club de l'Aube, at **Troyes,** France.

June 1-3.—Pruvost Grand Prix for helicopters, organized by Aéro-Club de France, **France.**

June 4.—Kronfeld Club, talk by David Ince, "Flying the Olympia 419," etc., at 74 Eccleston Square, **London,** S.W.1, at 20.00 hrs.

June 6.—Helicopter Association of Great Britain lecture, "Turbine Helicopters," by D. L. Hollis Williams, B.Sc., F.R.Ae.S. (Westland Aircraft, Ltd.), in the R.Ae.S. Library, 4 Hamilton Place, **London,** W.1, at 18.00 hrs.

KOLIBRIE AGENT.—Dornier-Werke, G.m.b.H., of Friedrichshafen and Munich, has been appointed to represent the Dutch N.H.I. company in West Germany for sales of the Kolibrie.

Birth Notices

Allchurch.—On May 7, at Karachi, W. Pakistan, to Elspeth, daughter of Mr. and Mrs. Thurstan James, wife of John Allchurch—a son (Toby James).

Cox.—On May 4, at Lincoln, to Jacqueline (*née* Syddall), wife of Sqn. Ldr. F. W. Cox—a son.

de Brett.—On April 27, at R.A.F. Hospital, Akrotiri, to Diana, wife of Wg. Cdr. R. J. H. de Brett—a daughter.

Gregg.—On May 3, at the British Military Hospital, Nicosia, to Ruth (*née* Tobitt), wife of Flt. Lt. J. L. Gregg—a daughter.

Grey.—On May 9, at 19 Queensdale Place, London, W.11, to Jane, wife of John Grey and daughter-in-law of the late C. G. Grey—a son.

Mitchell.—On April 30, to Pauline, wife of Flt. Lt. G. H. C. Mitchell—a son.

Vickers Valiant Suppliers (*see pages* 688-693)

Alltools, Ltd.; Altus Engineering Co. (Corsham), Ltd.; Atkins Laboratories, Ltd.; Boulton Paul Aircraft, Ltd.; The British Thomson-Houston Co., Ltd.; Brooklands Engineering Co., Ltd.; Burgess Products Co., Ltd.; H. V. Burlingham, Ltd.; E. K. Cole, Ltd.; Crabtree and Co., Ltd.; Cramic Aircraft Components, Ltd.; C.W.C. Equipment, Ltd.; Dinc, Ltd.; Dowty Equipment, Ltd.; Dunlop Rubber Co., Ltd. (Aviation Division); Eastmead Engineering Co., Ltd.; E.M.I. Electronics, Ltd.; Ericsson Telephones, Ltd.; E.R.S. (London), Ltd.; Export Packing Service, Ltd.

Farnham Engineering Works, Ltd.; Field Aircraft Services, Ltd.; Films and Equipments, Ltd.; Flight Refuelling, Ltd.; The Franco-British Electrical Co., Ltd.; R. H. H. Franks; Sir George Godfrey and Partners, Ltd.; G.Q. Parachute Co., Ltd.; Graviner Manufacturing Co., Ltd.; E. J. Guy, Ltd.; Harley Aircraft Landing Lamps; C. E. Harper Aircraft Co., Ltd.; The Henderson Safety Tank Co., Ltd.; Hendrey Relays, Ltd.; W. Henshall and Sons (Addleston), Ltd.; The Hercules Engineering Co., Ltd.; Heston Aircraft and Associated Engineers, Ltd.; Irving Air Chute of Great Britain, Ltd.; G. Johnson Bros., Ltd.; Johnson and Phillips, Ltd.

Kelvin and Hughes, Ltd.; George Kent, Ltd.; Walter Kidde and Co., Ltd.; Leverstart, Ltd.; Lever (Tolworth), Ltd.; Long and Hambly, Ltd.; McMichael Radio, Ltd.; Marconi's Wireless Telegraph Co., Ltd.; Marshalls' Flying School, Ltd.; Marston Excelsior, Ltd.; Martin-Baker Aircraft Co., Ltd.; M.B. Metals, Ltd.; M.L. Aviation Co., Ltd.; Louis Newmark, Ltd.; Newton Brothers (Derby), Ltd.; Normalair, Ltd.; North Kent Panels, Ltd.; Norbury Watch Co., Ltd.; Oldham and Sons, Ltd.; S. E. Opperman, Ltd.; The Plessey Co., Ltd.; J. T. Prince Engineering Co., Ltd.; R.F.D. Co., Ltd.; Rolls-Royce, Ltd.; Rotax, Ltd.; Rotol, Ltd.; Royston Engineering Co., Ltd.; Saunders-Roe, Ltd.; Smiths Aircraft Instruments, Ltd.; S.P.E. Co., Ltd.; C. F. Taylor (Metal Workers), Ltd.; Teddington Aircraft Controls, Ltd.; Triplex Safety Glass Co., Ltd.; T. and T. Tubecraft, Ltd.; Turner and Savage, Ltd.; Universal Equipment Co. (Northolt), Ltd.; Vernons Industries, Ltd.; Western Manufacturing (Reading), Ltd.; The Westnor Coachworks; Wincanton Transport and Engineering Co., Ltd.

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